AMERICAN MACHINIST

February 8, 1939

FILLING THE BREECH—*The manufacturing arsenals span the gap between the army and industry (page 48a)*

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McGraw-Hill Publishing Company, Inc.

Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 833 Mission Street; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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VOLUME 83 — NUMBER 3

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Published every other Wednesday, price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3.00 a year. All other countries (except Europe and British possessions in Eastern Hemisphere), $6.00 a year or 24 shillings. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

A McGRAW-HILL PUBLICATION

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Now, where are The Other 99?

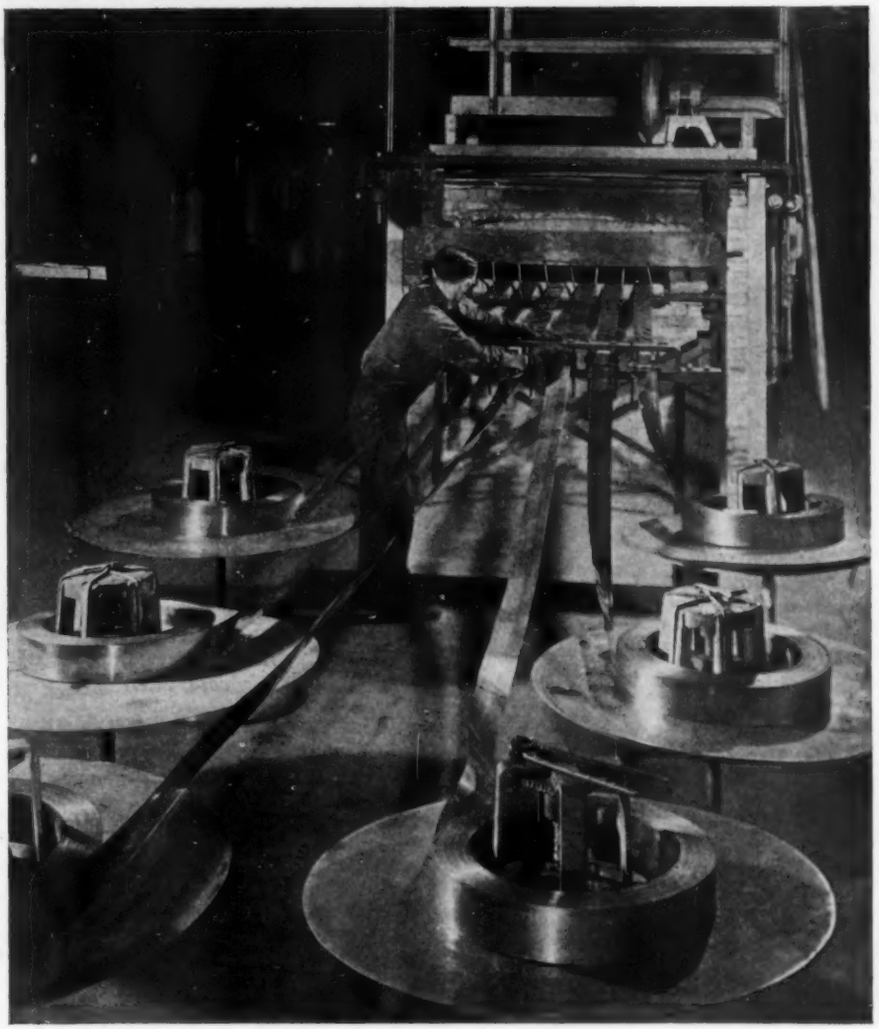
● In spite of the old parable, sometimes that hundredth sheep isn't worth the time or effort it takes to find him—particularly when the other 99 must be left unguarded while you hunt. You may find the lost one—and lose the other 99 doing it.

We used to acknowledge that Tom was the best shaper hand in the plant. He always got the tough dies, the hard layouts, the really special shaping jobs. And he always stuck with them until he whipped them, even if he had to figure out a new setup to do it. He used to brag that no shaper job would ever stop him, and wouldn't take a suggestion from anybody, even the Boss.

As far as I know, Tom is still the best shaper hand in that particular plant, maybe in that particular town. But the men whose advice he scorned now sign his pay checks. He's found that hundredth sheep, but he's lost the other 99 while he did it. His mind is still closed to new or broadening ideas, ideas of the kind you'll find a foot thick in both editorial and advertising pages of this and succeeding issues of *American Machinist*, if you'll just take the time to look.

Super Jim

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



Cold-rolled stainless steel strip entering a continuous annealing furnace

Heat-Treating Stainless Steel

Prepared in cooperation with the Stainless Steel Division, Carnegie-Illinois Steel Corporation

STAINLESS steels are heat-treated to secure maximum corrosion resistance or to develop an optimum combination of strength and ductility. In the case of the hardenable steels, the tempering temperature is selected to bring about the desired hardness, care being taken to avoid impairment of corrosion resistance.

The heat-treatment of any metal may be defined as the application and removal of heat, to a range of temperature, and at a rate, that will produce the strength, hardness, or whatever property may be desired. Heat-treatment may be used either to harden or soften, depending on the manner of cooling and the metal used. Briefly, the heat-treatment of steel is the formation of a solid solution of iron and carbon and its decomposition to the point where the metal will possess the desired physical properties.

The presence of a considerable portion of chromium, as in the steels of the stainless group, does not change the basic principle involved. It does alter the rate at which the transformations take place, retarding them materially. Further, chromium lowers the eutectoid ratio and substantially enhances the hardening effect of carbon, so that chromium steels with relatively low carbon will show equivalent hardness to plain

carbon steels of much higher carbon content.

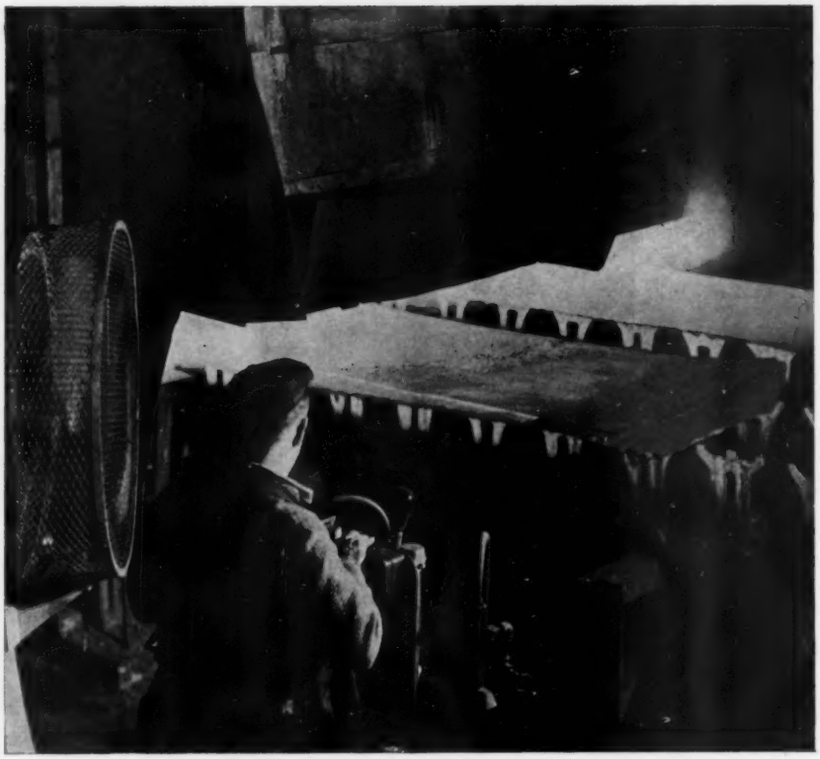
In the heat-treatment of stainless steels, the equipment used is necessarily of the same general character as is used for carbon steel and need not be discussed in detail. However, accurate control of temperatures is necessary; this must be provided for with suitable pyrometers and control equipment. Obviously, pyrometric equipment should be so arranged that the temperature indicated is that of the work being heat-treated and not merely the temperature of some part of the furnace. Stainless steels are all poor conductors of heat and require more careful heating and longer holding time than plain carbon-steels.

All furnaces should be amply large and of the muffle or, at least, semi-muffle type. Stainless steels should in no case be heated in direct contact with flames, or in a blacksmith's forge, as excessive scaling and carburization with loss in corrosion resistance will almost invariably follow.

As the temperature at which stainless steels must be heat-treated will, in general, exceed those for carbon-steels, proper thought must be given to refractories. These must be of a character that will withstand temperatures well above working ranges.

An important consideration is control of furnace atmospheres. At elevated temperatures stainless steels will decarburize in an oxidizing atmosphere, and will carburize in a strongly reducing atmosphere. Therefore, a neutral atmosphere is to be preferred. There is also the consideration of special atmosphere required for the "bright annealing" of strip and wire.

Due to variations in chromium content, carbon ranges, and the addition of other alloying elements, there are now over 40 steels in the general class listed as "stainless." Of these, about one-half are commercially important. As the very low chromium steels cannot be classified as "stainless," this discussion will be confined to those alloys, or steels, in which chromium exceeds 10 per cent.



Stainless steel sheets are heat-treated in continuous annealing furnaces by being laid on a "waster" sheet for the trip through the furnace. Conveying mechanism is below the furnace, except for supporting dogs

The stainless steels can be broadly divided into three groups:

1. Hardenable steels having critical transformation ranges and carbon-chromium ratios sufficiently high to produce definite hardening on sudden cooling.

2. Non-hardenable iron-chromium alloys with low carbon-chromium ratios which are predominantly ferritic in all conditions of heat treatment.

3. Non-hardenable austenitic alloys with high chromium and sufficient added elements, usually nickel, to render them austenitic at all temperatures.

Physical Properties of a Typical Low-Carbon Stainless Steel

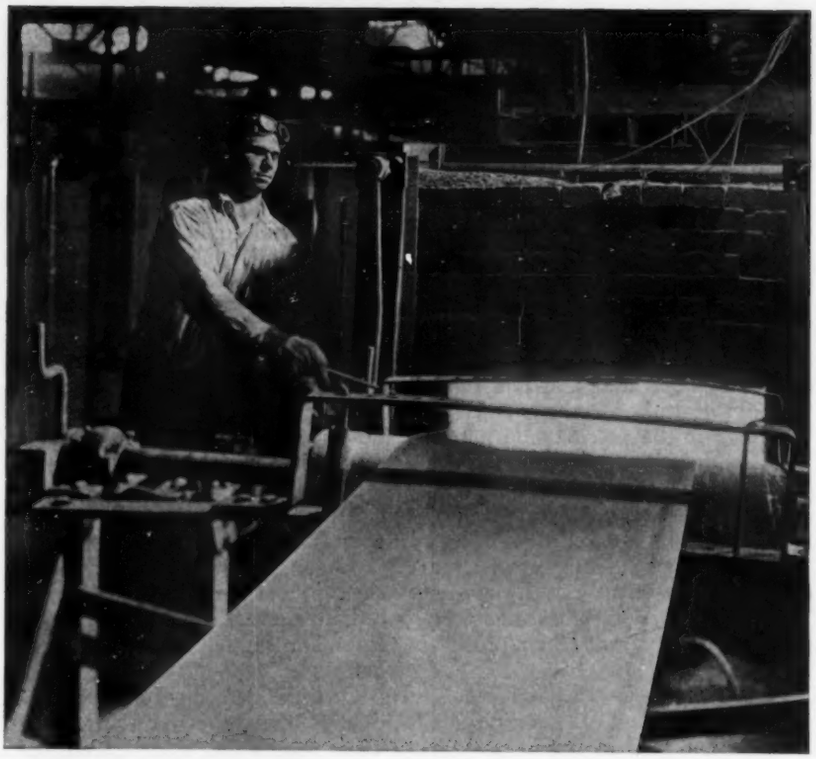
Treatment	*Yield Point*	*Tensile Strength*	*Elongation in 2 inches Per Cent*	*Red. in Area Per Cent*	*Brinell Hardness*	*I. Z. O. D. Ft. Lbs.*
500 F.....	179,000	198,000	19	58.0	375	45
600 F.....	179,000	198,000	19	59.8	375	43
700 F.....	184,000	199,000	18	59.8	363	46
800 F.....	187,000	201,000	18	58.5	375	42
900 F.....	178,000	200,000	20	59.0	363	27
1,000 F.....	166,000	180,000	19	62.4	352	10
1,100 F.....	112,000	127,000	22	68.0	248	35
1,200 F.....	103,000	117,000	23	68.0	235	91
Annealed.....	55,000	85,000	30	72.0	170	106

Type analysis: Carbon, 0.12 per cent max.; manganese, 0.50 per cent max.; silicon, 0.50 per cent max.; chromium, 11–13.5 per cent. Quench, 1,775 F. in oil.

Hardenable Steels

Hardenable steels will develop excellent physical properties on appropriate heat treatment, with high strength and elastic limit. The higher carbon ranges develop great hardness and abrasion resistance. All are air-hardening and magnetic. In corrosion resistance they are perhaps less valuable than the steels of the non-hardenable groups. The hardenable steels may be subdivided further depending upon chromium content and carbon-chromium ratio. In the first division, chromium is about 11-14.5 per cent with (a) 0.12 per cent maximum carbon and (b) 0.30–0.40 per cent carbon.

The low carbon steels (a), originally erroneously called "stainless iron," are capable of being hardened to about 350-400 Brinell. They are suitable for bolts, nuts and studs, high pressure steam valves and parts, steam turbine blading and similar applications. Heat-treatment for hardening consists of heating to 1,750-1,850 F., and cooling. Large sections should be quenched in oil, while



Extra-width, cold-rolled stainless steel strip emerging from a continuous annealing furnace. Furnaces for heat-treating stainless steels should be amply large and of the muffle or semi-muffle type

lighter sections will harden sufficiently by cooling in air.

Physical properties will vary with tempering temperatures in accordance with the accompanying table. The rate of cooling after tempering is immaterial. As this steel may be quite hard in the as-rolled condition, annealing will frequently be required before machining. The best practice is to heat uniformly and slowly to 1,400-1,450 F., holding long enough for complete soaking. As these steels are all air hardening, cooling must be done very slowly and in the furnace.

For greater machinability, especially for automatic screw machine production, a special steel of this analysis has been developed by small additions of zirconium sulphide, or of molybdenum and sulphur. This is known as "free machining" or "non-seizing." Its heat-treatment is similar to that given above but as great a hardness is not obtainable.

The high-carbon steel (b) of this division is the original stainless cutlery steel of Brearley. Because of its greater hardening capacity—up to 500 Brinell being obtainable on quenching—it is suitable for cutlery, surgical and dental instruments and the like. The hardening temperature is slightly higher than for the preceding steel, 1,850-1,900 F., quenching in oil for heavy sections or maximum hardness. Lighter sections may be cooled in air.

This steel may be annealed sufficiently for machining, blanking or trimming (200-220 Brinell) by holding at 1,425-1,475 F. for six hours and cooling slowly. For maximum softening (150-180 Brinell) hold at 1,600 F. for six hours and cool in the furnace.

In the second division of the hardenable steels, chromium will run 16-20 per cent. These are known as "modified cutlery type" and are produced in two carbon ranges (c) 0.60-0.70 per cent, and (d) 0.90-1.25 per cent. The former is used for high grade cutlery, surgical and dental instruments. The latter is also suitable for such articles, but is also used for bearings, and as a non-deforming tool and die steel. It has great hardness and wear resistance. The heat treatment of the modified cutlery types is the same as the preceding high-carbon type, (b).

Corrosion resistance of all the higher carbon hardenable steels is greatest in the hardened condition. When annealed these steels are not rust resistant, owing to the uncombined chromium carbides present in their structure. Low tempering temperatures are therefore recommended.

One of the effects resulting from increase in chromium content in low carbon steels is the raise in temperature of the alpha to gamma transformation, simultaneously with the lowering of the temperature of the gamma to delta transformation. With very low carbon these transformations merge at about 14-15 per cent chromium. Thus there results a virtually complete suppression of austenite formation. Hence, alloys with greater than this percentage of chromium are without critical transformations and remain ferritic under all conditions.

Commercial steels, however, will always have some slight percentage of carbon and some hardening will result on quenching, but this is usually too small for any useful purpose. Heat treatment of this group, other than for relief of stresses, is hardly a worthwhile undertaking.

The ferritic steels have good strength and ductility and are commercially important because of good corrosion resistance. Their chief application has been in the chemical industries for the construction of nitric acid plants. The higher alloys are unexcelled in oxidation resistance at high temperatures. All are magnetic.

The ferritic steels are represented by several commercial types: namely, 14-18 per cent chromium with 0.12 per cent carbon max., 18-23 per cent chromium, and 25-30 per cent chromium. The two latter with somewhat higher carbon as necessitated in melting practice.

The only heat-treatment of these steels that is possible is annealing for removal of stresses resulting from cold working or otherwise. In treating the 14-18 per cent chromium type, hold at 1,350-1,450 F. for a long period—not less than one hour per inch of section—and cool in air. In the higher chromium types a slightly higher temperature is desirable, 1,450-1,600 F., holding for a long time and cooling rapidly in air.

One of the characteristics of the ferritic steels is their rapid grain growth at elevated temperatures, which reduces ductility and impact strength. Since there are no transformations, coarse crystalline grains having once been found, there is no remedy, as heat-treatment is ineffective.

Austenitic Steels

Non-hardening austenitic steels contain chromium above about 17 per cent with sufficient nickel or manganese, or both, to render them austenitic at all temperatures. This is the familiar "18-8" type and in com-

mercial composition ranges will run up to 25 per cent chromium and 20 per cent nickel. Modified alloys containing molybdenum for greater corrosion resistance, silicon for oxidation resistance, and selenium for easier machinability, are important commercial steels. The steels of this group are non-magnetic.

This is the most important of the stainless group in point of general usefulness and tonnage produced. The steels combine high tensile strength with exceedingly high ductility and are highly corrosion resistant to a multitude of chemical media. Being austenitic at all temperatures, there is no phase change, and hardening by any kind of heat treatment is impossible. These steels, however, are by their nature subject to a decided increase in hardness on cold working, which renders machining and drilling operations somewhat difficult if improperly performed. They are definitely advantageous for construction of transportation equipment where reduction in weight is a consideration.

Heat treatment of austenitic steels will be required for (a) removal of cold working stresses and (b) for solution of carbides to produce maximum corrosion resistance.

Since austenitic steels are "cold worked" at relatively high temperatures, annealing temperatures must be considerably higher and 1,850-2,000 F. is recommended. The higher the temperature the greater the softening, but excessive temperature or too long holding will cause grain growth and must be avoided. Cooling must be as rapid as possible in all cases, and the necessity for this must be emphasized.

Rapid cooling is important since carbides are liable to precipitation along the grain boundaries in the temperature range 900-1,500 F. This impairs ductility somewhat and definitely renders the steel subject to intercrystalline corrosion. The latter may be so extensive in certain chemical media that the steel is practically disintegrated.

This phenomenon of carbide precipitation is common to all steels of the austenitic group. It will take place rapidly in the ordinary 18-8, but somewhat more slowly in the higher chromium-nickel alloys. It is a function of the carbon content and the time held in the precipitation range.

When carbide precipitation has occurred through fabricating operations, incorrect heat treatment or otherwise, the steel can be restored to full ductility and corrosion resistance by the annealing treatment given above. This redissolves carbides and the rapid cooling prevents their precipitation.

In the very low carbon steels, carbon 0.06 per cent or under, carbide precipitation even at maximum will be slight, and unless exposed to highly corrosive substances may generally be disregarded.

With modified austenitic steels such as those containing molybdenum or silicon, a more restricted heat treatment range, 1,950-2,050 F., is desirable. This must be followed by rapid cooling.

For the higher austenitic steels such as 25-12 or 25-20, and any of the steels with higher carbon, the heat treatment range is somewhat higher, 1,950-2,100 F., to be followed, as before, by rapid cooling.

The rapid cooling of the austenitic steels is highly important. Carbides are precipitated whenever the steel is heated in the range of 900–1,500 F., whether held in this range or cooled slowly through it. Water quenching is desirable, and should be employed for all sections $\frac{1}{8}$ in. thick and heavier. Water quenching is also advised for lighter sections, but sufficiently rapid cooling of light gauge material will usually be secured by an air blast.

As high temperature heat treatment and water quenching may be impractical with larger fabricated structures, it has been necessary to develop special steels of this type which do not require heat-treatment. Research has shown that certain elements, namely, titanium, columbium, tantalum, molybdenum and vanadium, possess greater affinity for carbon than chromium and, when present in sufficient proportion, act as binders for carbon, preventing the formation of chromium carbide in the grain boundaries.

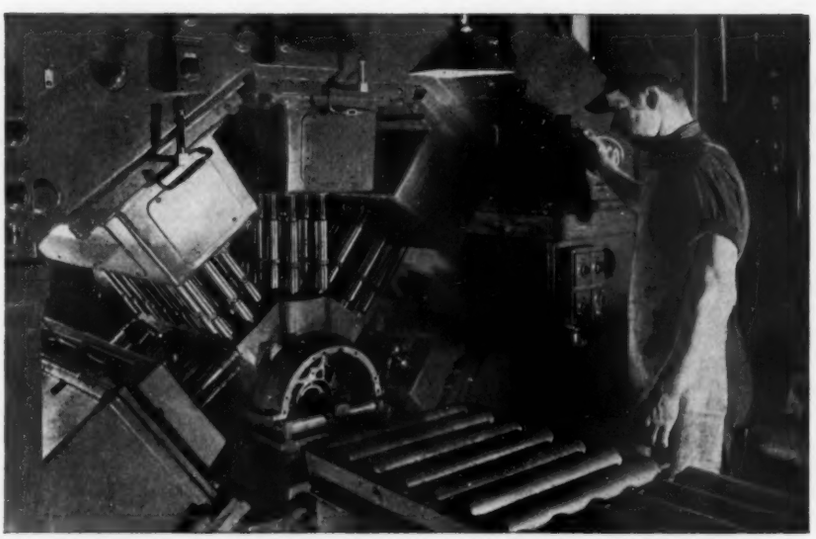
Of these elements, columbium and titanium are the most important. Their functioning is dependent on a heat treatment at moderate temperatures (1,550-1,650 F. for two hours) which "stabilizes" the respective carbides so that no further change can take place at lower temperatures, i.e., in the precipitation range. Steels of this type are termed "stabilized" and are particularly well suited for fabrication by welding. Once properly stabilized no further heat treatment, other than that necessary to relieve stresses, is necessary.

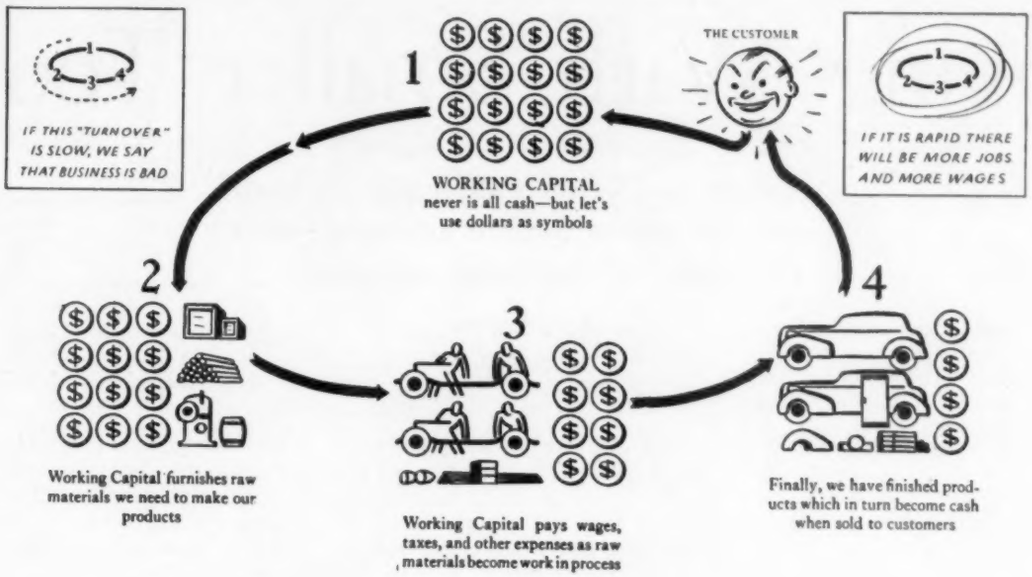
Molybdenum, present in 18-8 Mo. to the extent of some 2-4 per cent, is chiefly useful in increasing general corrosion resistance and is also useful, to a degree, as a stabilizing element.

Wholesale Tapping

WHAT could emphasize the advance of machine over hand work more than the tapping of all holes in a V-12 cylinder block at once? What a chore it would be to tap the 87 holes by hand? And how many of them would be square with the block? Studs set in a hand-tapped block would resemble a cornfield after a heavy blow. Here they are all in line, are all tapped to the right depth, and in less time than you can hand-tap a single hole.

To complete the job on the bottom of the block a comparatively simple tapper is used. The Lincoln-Zephyr block is squared by being held up against a plate while the taps—only about 30 in this case—are at work.




IF THIS "TURNOVER" IS SLOW, WE SAY THAT BUSINESS IS BAD
1
WORKING CAPITAL never is all cash—but let's use dollars as symbols
THE CUSTOMER
IF IT IS RAPID THERE WILL BE MORE JOBS AND MORE WAGES
2
Working Capital furnishes raw materials we need to make our products
3
Working Capital pays wages, taxes, and other expenses as raw materials become work in process
4
Finally, we have finished products which in turn become cash when sold to customers

What Is Working Capital?

Attempting to give its employees an understanding of the fundamental principles of running a business, General Motors Corporation recently published in its magazine *Folks* an explanation of what is meant by working capital. The text was accompanied by simple drawings which helped to drive home the principles involved. The explanation was so clear that *American Machinist* has secured permission of General Motors Corporation to reprint it.

NET working capital is the total amount of funds available for the day-to-day, or current, needs of the business.

Working capital dollars are called on to do several different kinds of jobs. When orders come in (or there seems to be a fair prospect for orders in the near future) raw materials and supplies must be purchased and stored ready for use. You know how important it is always to have on hand the right amount of each of the many raw materials we need, so that there are no interruptions in production.

As the work progresses there is a lot of material moving through the shop "in process" and finally there are finished parts, component parts, or finished products which are stored until sold. All of these—raw materials, work in process, and finished products—go to make up *inventories*. Maintaining inventories is one of the important uses of working capital.

A considerable part of working capital usually is in cash or cashable securities, needed to meet the expenses of the business as they arise. Thus, provision must be made for meeting payrolls, bills for materials, freight, advertising, working tools, and other regular expenses. Most businesses try to keep at least enough cash on hand to meet bills for sixty days.

At certain times of the year a major part of our working capital is tied up in *inventories*, leaving our cash relatively low. At other times cash must be built up so that payrolls and bills can be met when things begin to pick up. During the winter months a part of our cash is used to build up inventories and this evens out employment.

Taxes are another expense which must be met promptly. Dividends to stockholders for the use of their savings also are paid from cash on hand.

In many ways, working capital is to a business what gas in the tank is to a car. No matter how fine and mechanically perfect a car may be, without gas in the tank it is of no use to anybody. A business suffering from lack of working capital can't run very long or very well.

For that reason, it is one of the first responsibilities of management to see that adequate working capital is on hand to meet payrolls, buy raw materials, provide for power and light, maintenance of tools and plants and all the other expenses so that work can go on without interruption.

Of course, the *customer* is the driver of the car of business. When he steps on the accelerator it means that the flow of working capital through the business is speeded up and things begin to hum. By doing our best to give the customer the greatest possible value for his dollar all of us can help encourage him to "step on it."

But the working capital dollars must be there and ready to use when the customer decides to step on the gas, because on working capital depends the day-to-day operation of the business—the purchase of raw materials, the payment of wages, and all the other activities that keep a business going.

Saving With Smaller Tools

Holders and adapters designed for small tool bits can be used to advantage on a number of machining operations

E. F. SMITH
Haynes Stellite Company

USE OF tool-bit adapters and holders is economical, especially when applied to machining operations like turning, facing, boring, recessing, grooving, and cutting-off, where solid bits are used. In many cases machine tools, when originally purchased, are fitted with tool blocks, tool holders, or adapters for certain definite operations. Subsequent changes in the part or material to be machined, or in production requirements, make the holders unsuited for the proper size or design of cutting tool to give efficient operation under the new conditions.

Many production shops have realized this and have equipped their machines with improved tool holders or adapters. Tool bits of smaller cross-section have been substituted, where possible, and holders, boring bars, and tool blocks are redesigned to take advantage of the short, previously unused sections of the standard bits employed. While the salvage value of the unused portion of some tools is appreciable, the reduction of these portions to an absolute minimum by their continued use in improved holders makes it possible to reduce replacement costs to such an extent that some plants have found it economical to detail a tool engineer to provide holders and adapters specifically suited to each operation.

Standard tool bits of square and rectangular cross-section generally are preferable from a cost standpoint. Not only is the purchase price lower because the tools are *standard* as opposed to *special,* but standard tool sizes are stock items and can be obtained without delay. In addition, they can be put into use almost immediately upon delivery, because only simple grinding operations—changing the profiles or clearance angles—are necessary.

Tool cost is dependent not only on the original price of the bit, but also on the speed of stock removal, the number of pieces per grind, the salvage value of the short end, and the time required to regrind an individual bit. Since the size of the tool controls both the original cost and, to a large extent, the time required for each regrinding operation, adapters which allow the use of bits of smaller cross-section obviously can effect considerable reduction in tool costs.

The simplest design of tool bit

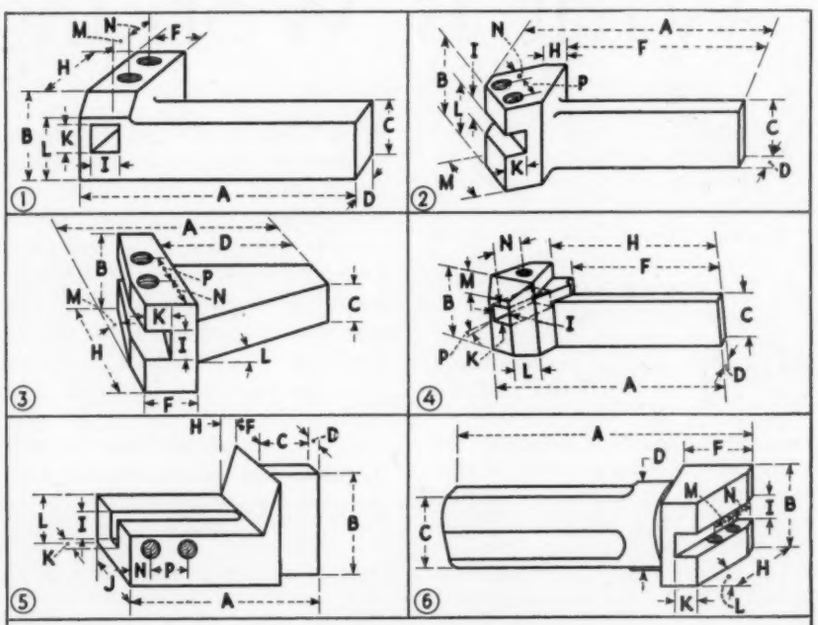


TABLE OF DETAIL DIMENSIONS

TOOL NO.	A	B	C	D	F	H	I	K	L	M	N	P	SET SCREW
1	6"	2"	1¼"	1"	1⅛"	2¼"	31/32"	31/32"	1½"	½"	1"	–	⅜-11 N.C.
2	4½"	1¾"	1"	½"	3 7/16"	⅜"	⅜"	7/16"	1"	½"	⅜"	¾"	⅜-16 N.C.
3	4"	1⅛"	¾"	3"	1"	2¾"	17/32"	⅝"	15°	10°	¾"	1"	⅜-16 N.C.
4	5⅛"	2"	1¼"	½"	3½"	4"	31/32"	21/32"	11/16"	½"	¾"	7°	⅝-11 N.C.
5	4¼"	2"	1"	½"	¾"	¼"	17/32"	17/32"	1"	1½"	½"	¾"	⅜-16 N.C.
6	8¼"	2¼"	1⅞"	1.999"	2¼"	2¼"	0.500"	⅝"	30°	1"	½"	–	½-13 N.C.

Fig. 1—Tools Nos. 1 to 6, inclusive, have been designed to provide adequate support, even when the small tool bit has been reground until quite short. Setscrews are placed as near the end of the holder as possible in order to reduce length of scrapped bits to a minimum

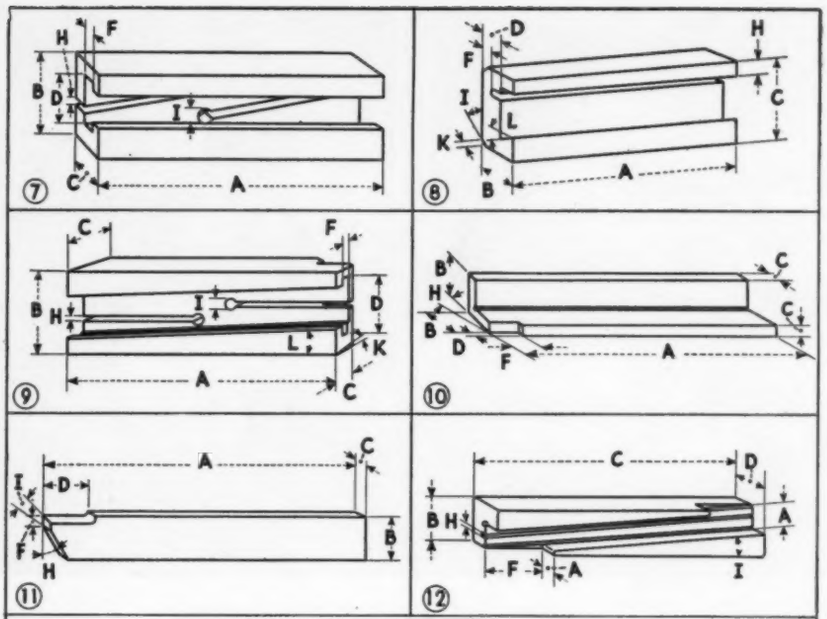


TABLE OF DETAIL DIMENSIONS

TOOL NO.	A	B	C	D	F	H	I	K	L	TOOL NO.	A	B	C	D	F	H	I
7	5"	1½"	13/16"	7/8"	9/32"	1/4"	1/4"	–	–	11-F	4 15/16"	47/64"	1/4"	9/16"	3/8"	45°	7°
8	4"	3/8"	1½"	1/2"	3/16"	1/4"	45°	1/16"	5-15°	11-H	5 3/16"	23/64"	1/2"	7/8"	1/4"	45°	7°
9	4"	1¼"	3/4"	0.760"	0.106"	1/16"	1/8"	10°	5°	12-A	1/2"	0.750"	6"	0.750"	1¼"	1/16"	2° 41′
10-A	4 3/4"	29/64"	1/8"	–	–	7°	–	–	–	12-B	1/2"	0.875"	6"	0.875"	1½"	1/16"	3° 35′
10-B	5 5/16"	27/64"	1/4"	3/32"	5/8"	7°	–	–	–	12-C	5/8"	0.875"	6"	0.875"	1½"	1/16"	2° 23′
11-A	5¼"	32/64"	1/8"	–	1/4"	40°	–	–	–	12-D	1/2"	1.000"	6"	1.000"	1¼"	1/16"	4° 46′
11-B	4 15/16"	47/64"	1/4"	–	5/16"	30°	–	–	–	12-F	5/8"	1.000"	6"	1.000"	1½"	1/16"	3° 34′
11-C	4¾"	29/64"	1/8"	–	1/4"	30°	–	–	–	12-H	5/8"	1.250"	6"	1.250	1"	1/8"	5° 57′
11-D	4 7/8"	27/64"	1/4"	3/4"	1/4"	30°	7°	–	–	12-K	3/4"	1.250"	6"	1.250"	1¼"	1/8"	4° 46′

Fig. 2—Holders similar to tools Nos. 7, 8 and 9 are particularly suited for holding parting or grooving tools. The first two are arranged for use against a shoulder, while the third is designed for use in a tool holder. Adapter sections and blocks, similar to tools Nos. 10, 11 and 12, make possible efficient change-over of tooling on a machine with little or no additional cost

holder involves making one which will give one bit a maximum of support even when the bit has been reground until quite short. A direct saving results immediately. For instance if a tool holder provides an ample setscrew locking as near the end of the holder as possible, scrap is reduced to a minimum.

Some of the tool holders which have been found profitable when used in turning, facing, and boring operations, are shown in Fig. 1. These six holders represent general types for a wide range of applications; all are suitable for holding used bits which have been ground too short to be used in the holders for which they originally were purchased.

For holding parting or grooving tools, holders such as those shown in Fig. 2 have been found particularly applicable. Tools Nos. 7 and 8 in Fig. 2 are designed to be used against a shoulder, while tool No. 9 is to be used in a previously made tool holder. In cases where a solid cut-off tool has been substituted for a ¾-in. welded-tip tool in this holder, a decided increase in production has been obtained, together with considerably longer tool life.

Adapter Sections Useful

Adapter sections and blocks which have been very successful for reducing tool bit cross-sections are shown as tools Nos. 10 and 11 in Fig. 2. It was possible to use simple adapters of this type on 65 per cent of the machines surveyed in one plant. The change-over materially reduced the replacement tool costs at no sacrifice in production. In many instances, too, a very substantial increase was obtained in the number of pieces per grind over the number possible with the formerly used larger tool bits.

Because, in some cases, the machine tools for which one or another of these holders are designed later may be transferred to operations of a similar nature, but with different tooling, adapters similar to that shown as tool No. 12 in Fig. 2 often are made up either right- or left-handed. They then will permit the use of ½-, ⅝- or ¾-in. bits in holders previously made for ¾-, ⅞-, 1-, or 1¼-in. solid tools.

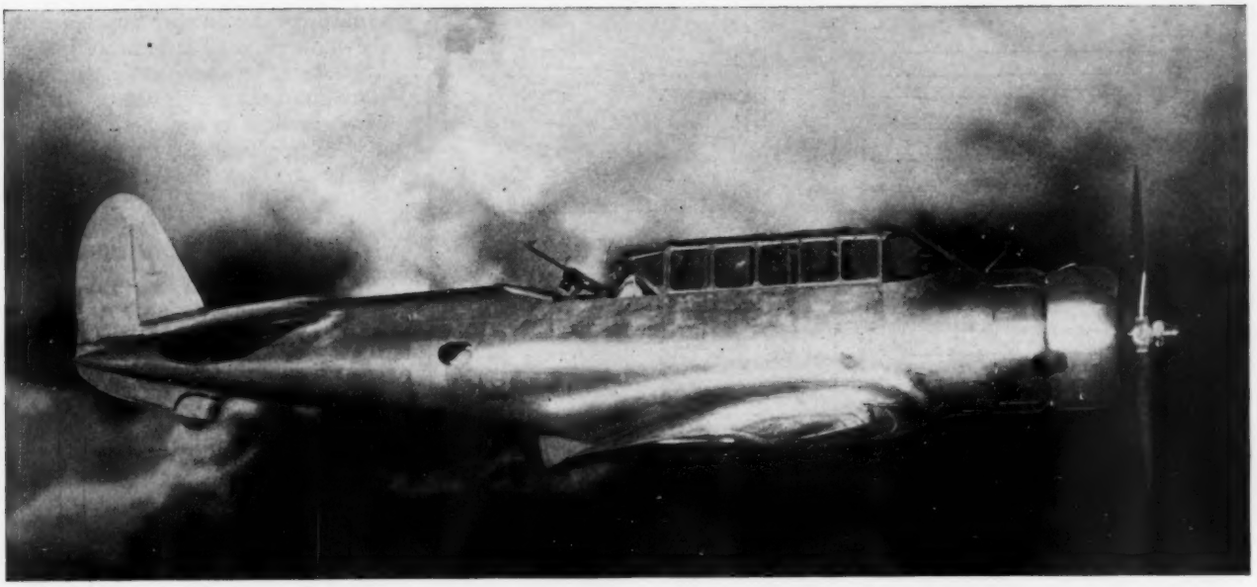
Typical of the savings made possible by using adapters which permit Stellite J-Metal tool bits of smaller cross-sectional area to be used on machining jobs formerly assigned to larger tools are those effected on four machines in one department of an automotive manufacturing plant. These machines are set up for machining differential housings, carriers and cases. The reduction in original tool cost was $30.17, $25.61, $91.87 and $65.46 respectively for each of the four machines. That the total savings in original tool costs on one machine alone can be as high as $91.87 out of a previous total tool cost of $127.56—over 70 per cent—by using inexpensive tool adapters, is a possible cost reduction that speaks for itself.

These holders, adapter sections and blocks are of simple design and can be made inexpensively in any shop. It is necessary only to check costs on tool sizes to visualize the savings possible.

Economics for the Shop

GORDON W. RICHARDS

The State of New Jersey recently appropriated a large sum of money for the training of apprentices through the public schools. One of the first steps was the organization of classes in economics. Why a class in economics? What has economics to do with learning the machinists trade? Well, far-fetched as it may at first seem, the study of economics is important to each of us, machinist or no. It serves to give a better understanding of the system under which we all labor. We understand that these particular classes had such varied subjects as compensation laws, labor unions and even the stock market—fully explained and discussed. And the fellows claim it was doggone interesting, too. They feel that a similar class for the other workers in the shop would be worthwhile indeed.



Vultee V-11GB attack-bomber—Ingenious jigs, fixtures and set-ups effect a high order of workmanship in production machine tool methods developed for building these planes

Machine Production of Airplane Parts

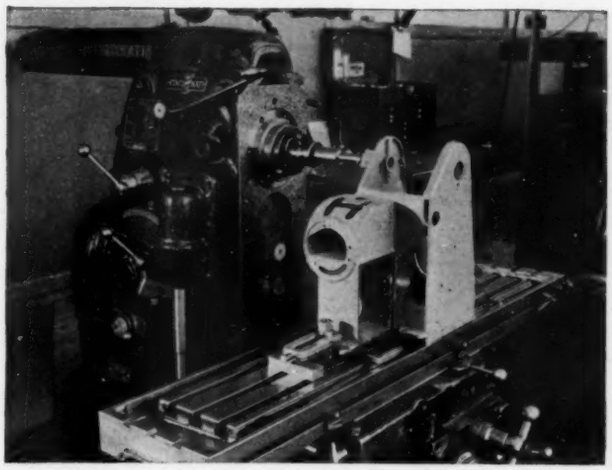
Modern machine tool methods applied to a wide variety of aircraft parts aid in speeding final plane assembly

DON I. CARROLL
Plant Manager, Vultee Aircraft Division of Aviation Manufacturing Corporation

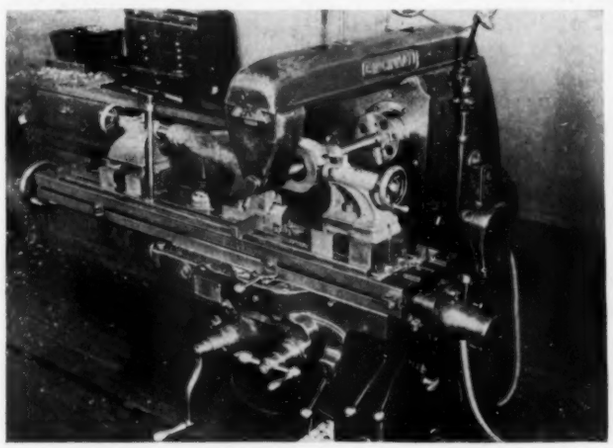
IN AN EARLIER article (*AM*—Vol. 83, page 1) we outlined some of general ways in which the Vultee V-11GB plane was designed for machine production. It was found that when engineers adapted their airplane design to make possible greater use of the machine shop, ways and means had to be evolved to convert satisfactorily the engineering drawings into finished airplanes.

In aircraft machine work, there are two major differences from more conventional machine work. The first is the almost universal use of light alloys of aluminum and magnesium. The second is the relatively greater bulk of the parts being machined. The materials machined consist largely of castings and forgings, although a department has been developed for the cutting or profiling of sheet materials; this will be discussed in more detail in a later article. We also have our share of steel and bronze machine work, especially in connection with heavily stressed parts such as the landing gear and actuating systems. Furthermore, a rather large percentage of our work is done on milling machines rather than on lathes; therefore, some of our more difficult problems have been in connection with mill set-ups.

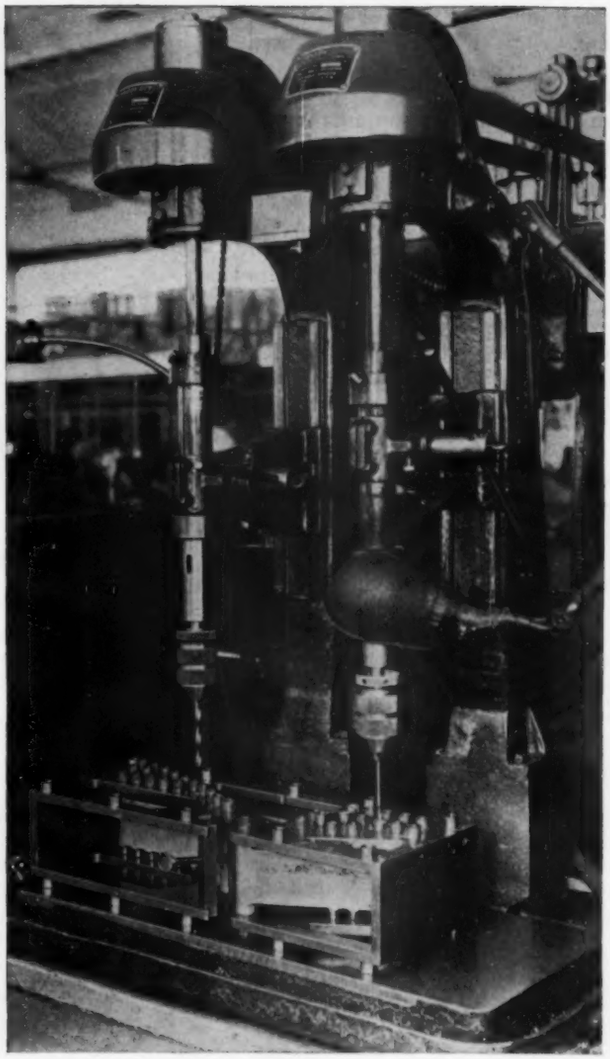
The Vultee machine shop proper occupies an area of but some 4,000 sq. ft. in a plant with a total floor space of about 200,000 sq. ft. Of course much of the plant space is devoted to storage, or to assembly operations. Actually more than 12 per cent of all labor hours is accounted for in the machine shop; neither this percentage figure nor the area given for the shop includes the extensive drop-hammer shop, foundry or the profiling department. In the Vultee machine shop we have eight millers; a shaper; nine lathes, including two automatics and three turret-head lathes; eighteen drill presses; and other necessary items of machine-shop equipment. The machine shop is located adjacent to the tool room, engineering department, planning department, stock room, raw-stock storage, and metal-fitting department, and is at the head of a production-line arrangement which includes two wing departments, the fuselage department, the center-section department, and the final assembly line. This arrangement places the machine



In this set-up the main axle support holes are bored; the piece is a magnesium casting for the Vultee control pedestal in which is centered operation of the engine, landing gear, flap gear and propeller



Boring, reaming and turning a hub for a felt grease retainer on the Vultee landing gear axle and oleo cylinder are done in the same set-up with the same boring bar in a Cincinnati milling machine



Holes are drilled from both sides and reamed to close tolerances to take long through bolts in the main wing beam center section cluster casting; a precision jig makes symmetry possible

shop where it very properly belongs, at the physical heart of the factory. Parts are processed through the machine shop for use in practically all other departments, and they flow efficiently from the raw-stock to other departments where they are assembled into the sub-assemblies which eventually make up the finished airplane.

One of the first things we learned, when we undertook machine production of a wide variety of aircraft parts, was that a relatively few machines must be made available for as many jobs as possible. This is essential from the standpoint of economics, because an airplane factory cannot bear up under an unlimited overhead. Machine tools represent a relatively heavy investment and they must be kept working 24 hours a day if feasible, to retire the investment as quickly as possible. Therefore, we have developed a great many ingenious fixtures and set-ups to accomplish the triple purpose of producing the best possible work, doing it efficiently, and keeping all of our machines busy at all times.

Our machine work is divided generally into two classes, structural and operative. The structural work usually involves milling and drilling operations primarily. The operative work concerns actuating systems, control systems, etc. The latter class of work is rather conventional, involving gears, shafts, brackets, etc., and does not cause nearly as much trouble as the structural work. This is due partially to the fact that the structural parts are usually larger and more difficult to handle, and partially because some of the structural tolerances are rigid and unusual, as in the case of holes drilled in the gunner's seat back casting, which is a large ring segment with a diameter of approximately 30 in. It is necessary to drill 12 holes in this segment, at various points along its arc, and all of them must be drilled to a common center. These holes must also be reamed to close tolerances. To do this job we have developed a swinging fixture which is attached to the table of a Cincinnati horizontal miller. The fixture is indexed for location of the holes and the drilling and reaming is done with tools mounted on the mill shaft. We also use another mill set-up for this same part, in order to drill the large holes in

the bracket at each end of the casting. These holes accommodate the support tubes for the machine gunner's adjustable seat and must be held to close tolerances on location and diameter.

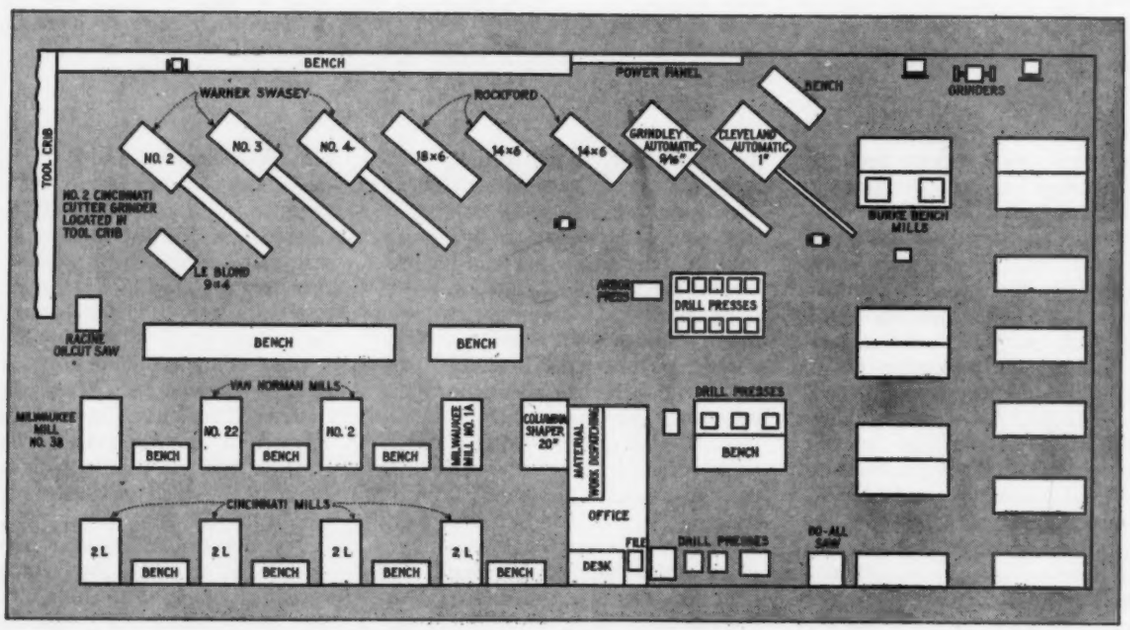
A similar problem is met in drilling and milling the gun ring mount. This is a ring segment, slightly larger than the gunner's seat ring, and is quite interesting inasmuch as it comes into the plant as a straight extruded channel of approximately I-beam cross section. This channel is cut to length and is then rolled to form a proper arc in the Vultee rolling machine. It is then given a circle diameter cut on the outside flanges by means of a special set-up on a profiling machine. This work is held to a tolerance of 0.002 in. The part is then delivered to the machine shop and there we drill 12 taper holes for mounting roller supports. These holes must be drilled to a common center and are reamed to an accurate taper. For this work we use a swinging fixture on a Cincinnati horizontal miller, very similar to the set-up used for drilling the machine-gunner's seat ring. The inside flanges of the ring are then milled at each end in another mill set-up in order to provide for bracket clearance at the points of attachment to the gunner's seat ring.

A much smaller part presented a somewhat bigger problem. It was required to mill a radius of approximately 8 ft. on a small cast-aluminum bomb-rack fitting, making it necessary to rig up a rather bulky superstructure for attachment to a vertical mill. This supports a long arm, the head of which carries a fixture for supporting the work. The head of the arm is in turn retained in a slide fixture clamped to the mill table. Thus the table may be traversed backward and forward in the customary way in order to carry the work, on its swinging arm-sliding head support, past the vertical milling cutter in the required arc. This swinging-arc milling operation on the shoulder of the bomb-rack bracket is the third machine operation required. The first is a straddle milling operation on the center flange of the bracket. Then it is necessary to drill a number of small bolt holes in each shoulder of the bracket, on each side of the center flange. The third operation is the radius milling of the shoulder as described above. This bracket is also faced on a shaper and drilled for attachment to the structure of the plane.

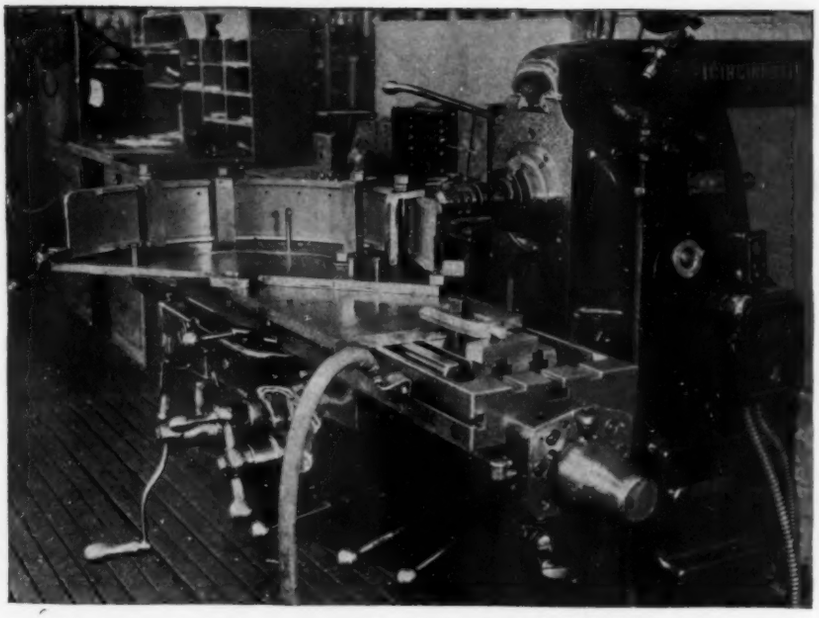
Another example of the type of machining required for the Vultee attack-bomber is that done on the magnesium-alloy control-pedestal casting. This complex casting is a hollow box of extremely irregular shape. Throughout the plane we have numerous other such boxes, as gear boxes, etc., but the control pedestal is the most complex. It carries multiple control levers for actuating the carburetor, altitude adjustment, propeller setting, flap extension, landing gear retraction, etc. Machine work is done mostly in a miller and includes boring, reaming, and facing.

An excellent piece of precision milling and drilling is done on the alloy casting used at the attachment point of the center-section main wing beam to the major fuselage bulkhead ring. This casting is step straddle milled, the ends being cut narrower than the center portion of the casting, which must fit between the gusset ears of the top and bottom cap strips. The main body of the casting is then straddle milled to take the fuselage rings which are attached both to this casting and to the spar-cap gusset plates which also straddle the ends of the casting. It is obvious that the drilling operation calls for precision because, at the ends of the casting, long through bolts must pass through two fuselage rings, both gusset plates of the spar caps, and the cluster casting proper. This drilling is done in a symmetrical jig which is reversed to drill from both sides. Holes are then reamed to close tolerance. The result is a fitting which materially speeds final assembly of the plane, and assures quick easy disassembly for maintenance or repair of major parts of the airplane structure throughout the life of the equipment.

Another precision milling and drilling operation is that performed on the large aluminum-alloy castings used in attaching the landing gear to the stub wing. As the gear must retract and extend, in addition to bearing the heavy loads of landing in rough fields, this part must be processed to very close tolerances, particularly with respect to parallel milling between three separate pairs of ears and to the facing of bottom



The Vultee machine shop, which occupies 4,000 sq. ft. of a total plant floor area of 200,000 sq. ft., utilizes many fixtures and set-ups to keep a relatively few machines in continuous operation



Gun-ring mount set-up on a swinging fixture for drilling and reaming taper holes to a common center, and for milling bracket clearance on the flange ends

and top surfaces which control mounting of the fitting to the airplane structure. Sequence of operations first calls for parallel milling between all three flanges or ears. The bottom faces are then located and milled with reference to the finished surfaces of the ears. Thereafter it is relatively simple to locate and drill a total of 34 holes, some of which are angle holes and seven of which are threaded for machine screws.

Another interesting item is the aluminum-alloy rudder-pedal arm. This part has a long bearing hole at the base, and a shorter bearing hole at right angles to the base in the upper end of the arm. Temporary set-ups are used for this work, which is performed largely in a horizontal mill. The long hole is first bored and the ends of the long cross arm are then milled for center distance. The short hole is then located and bored and the ends milled. A vee block and bushing is used for drilling attachment-bolt holes in both cross arms, the tool used being a combined drill and facing cutter, which continues on down and mills off the shoulder after drilling the hole. This operation is performed from both sides of the casting to check alignment of the bolt hole and face both shoulders.

One of our important machining jobs is finishing the landing gear axle and oleo-cylinder assembly. This is a single structural unit assembled from steel tubing and flat sheet-steel plates, welded together. It is a costly part to manufacture, even before machining, and is extremely important in the operation of the airplane inasmuch as it carries the entire weight of the main wheels and provides for the shock-absorbing action which helps smooth operation on rough fields. This part mounts vertically in the landing gear leg, which is in turn retractable into the wing of the airplane. In operation the oleo cylinder slides up and down in the main support strut, being guided on slides by two vee blocks. The wheel axle is cantilevered at right angles to the oleo cylinder from a heavy support at the bottom of the unit. Machine operations include boring of both holes and milling the vees. The oleo cylinder is first rough bored with a gun drill mounted in a lathe, after which the end of the cylinder is turned and threaded on the outside diameter to take the packing collar. The cylinder is then reamed with an adjustable reamer and honed to a tolerance of 0.0015 in. The short axle-support hole is bored on a horizontal mill, the set-up providing for boring and reaming the hole and turning the outside diameter of the stub tube to take a felt grease retainer, all with the same boring bar. Final operation is the milling of the two guide vees with special cutters; this is done to close tolerances since the vees serve as mountings for bronze vee blocks which act as sliding bearings for the landing gear vertical shock-absorber action. These bronze vee bearings are premachined to a high degree of accuracy and assembled directly to the vees by means of long through bolts accommodated in holes drilled just inside the trough of the vee.

Guide V's on Vultee landing gear oleo-axle part are milled to micrometer dimensions with special cutters

The foregoing examples of Vultee machining operations represent a small proportion of the work going through our machine shop, but they will serve to give a cross section of the type of work done, as well as to illustrate the need for ingenuity and a high order of workmanship in helping machine tool methods to speed airplane production. A later article will deal with some of the special machines we have developed for problems peculiar to aircraft work.

IDEAS FROM PRACTICAL MEN

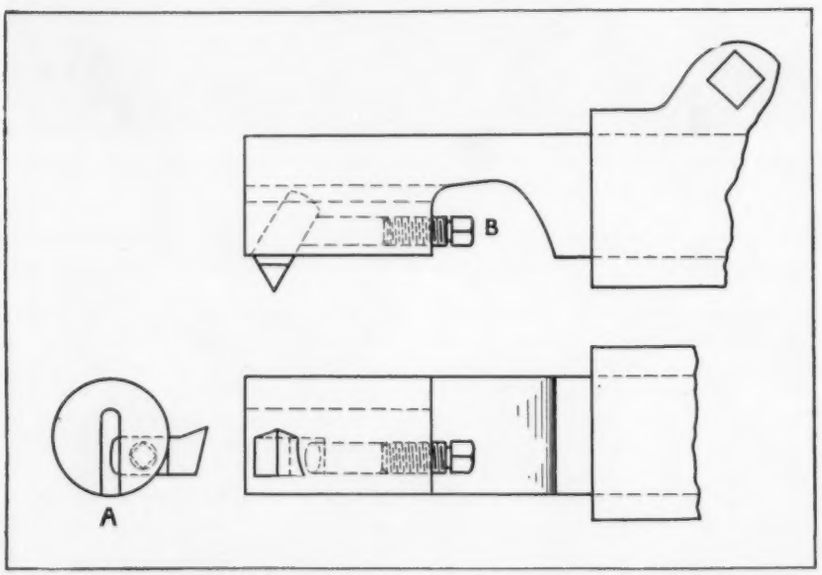
Spring Bar for Cutting Internal Threads

D. D. WELLS

An unusual application of the well-known resilient principle of tools of the gooseneck type to a bar for boring and cutting internal threads is shown in the illustration. The bar is of the conventional toolpost type and has a ¼-in. axial slot cut at the end, extending well beyond the center and into the recess *B* which is both for clearance in assembling the screw that holds the toolbit and for a runout for the slot.

In use, the bar is set so that slot *A* is vertical with its open end down. When the toolbit meets with undue resistance from the cut, the part holding the toolbit springs in a twisting direction, tending to close the mouth of the slot and relieving the toolbit from the cut, thus preventing chatter. The diameter of the bar and the projection of the toolbit must, of course, be such that when the toolbit is in the cut, the pivotal point of spring in the bar will be well above the center of the work. Otherwise the toolbit would dig into the work instead of being relieved.

This slotted bar was developed in the oil fields for threading the "joints" in a "string" of well-drilling tools which must have glass-smooth taper threads. It has since been adopted by some railroad shops for use in turret lathes.



Undue resistance of the work to the toolbit causes the bar to spring, relieving the toolbit from the cut and preventing chatter

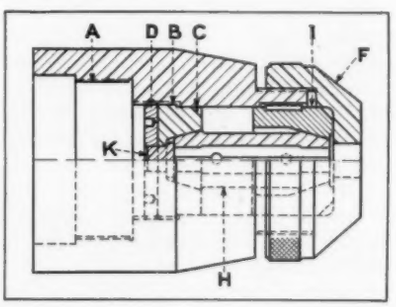
Collet Chuck for Holding Thin-Walled Tubing

W. M. HALLIDAY
Millfield, Peterborough, England

The collet chuck illustrated was made for holding short lengths of thin-walled aluminum tubing for squaring and threading the ends in the lathe.

The body of the chuck is bored as shown, being internally threaded at *A* for attachment to the lathe spindle, and at *B* for the internally tapered bushing *C* and the locknut *D*. The outer end is externally threaded for the cap *F*. Bushing *C* has an unthreaded portion fitting the bore of the body, its purpose being to maintain concentricity. The collet *H* is alternately slit from each end and both ends are tapered to fit the internal tapers of bushings *C* and *I*. Bushing *I* is prevented from turning in the body by a small feather key. Cap *F* is internally threaded to fit the threads on the outer end of the body and has a knurled band for a hand grip. The headed plug *K* is inserted through the holes in bushing *C* and the locknut *D* and serves as a stop for the inner end of the tubing.

In operation, with the cap backed off, a tube is passed through the collet and against the stop. Tightening the cap forces bushing *I* inward, closing the outer end of the collet on the tube. At the same time, the collet is moved inward and its movement forces its inner end into the tapered bore of bushing C. Thus both ends of the collet are closed on the tube.



The collet, alternately slit from each end and tapered at both ends, is closed by two internally tapered bushings when the cap is tightened

Improving the Slide Rule

G. R. BLAKELY
Hitchin, Hertfordshire, England

Referring to the article under the above title by H. B. Schell (*AM*—Vol. 82, page 774), the writer is in complete agreement with him as to the advantage of transferring *pi* to the *D* scale of the slide rule, and he finds it difficult to understand its omission, which occurs on American rules as well as on the majority of European ones.

An even simpler method of locating *pi* on the *D* scale than that described by Mr. Schell was used by the writer who suddenly found urgent use for it when using a new slide rule under conditions where a square was not available.

The problem was solved quickly by utilizing the very close approxi-

mation obtained by dividing 355 by 113, a very useful ratio that is correct to one in ten million, and easily remembered by writing the figures 113355 and splitting them in the middle.

Setting 113 on the *C* scale to 355 on the *D* scale, the initial index on the *C* scale had only to be extended to the *D* scale, which was quickly and readily done by holding a steel rule across the initial index of the *C* scale as nearly square as could be judged by eye and drawing a sharply pointed knife along the edge of the rule. Thus the position of *pi* was scribed on the *D* scale.

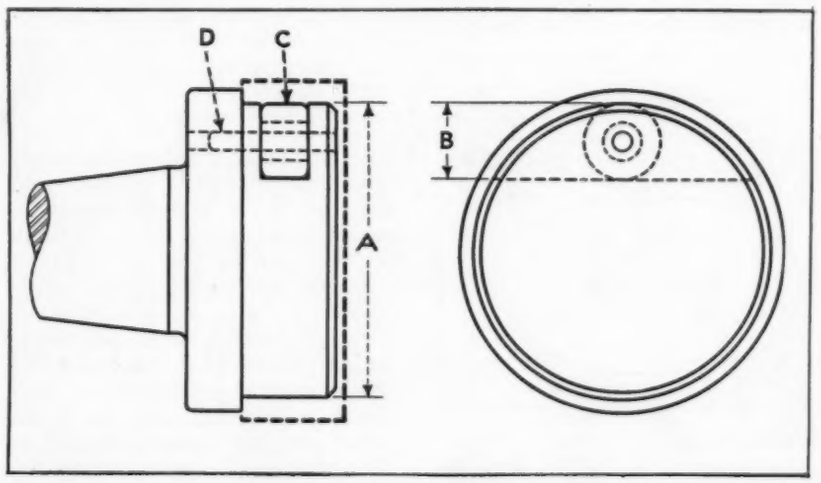
Quick-Loading Stub Mandrel

J. A. BRASSARD

The stub mandrel illustrated is for holding comparatively small, thin-walled rings for turning the outside and facing one edge, the bore and the opposite edge having been machined in a previous operation.

The work-holding end of the mandrel is turned to a diameter *A* from 0.0005 to 0.001 in. smaller than the minimum bore of the rings, leaving a shoulder for the rings to butt against. The slot *B* is milled across the body of the mandrel and is $0.500 \pm \frac{0.002}{0.000}$ in. deep. The roller *C* is $0.498 \pm \frac{0.001}{0.001}$ in. in diameter and has a $\frac{1}{4}$-in. hole for the pin *D* which is $\frac{1}{8}$ in. in diameter.

In use, with the roller uppermost, a ring is slid on the mandrel up to the shoulder and the spindle is turned clockwise until the roller, being loose on the pin, drops down in contact with the ring. Giving the ring a quick twist clockwise jams the roller between the bottom of the slot and the bore of the ring, locking the ring on the mandrel. The greater the pressure of the cut, the tighter the ring will be held. To remove the ring from the mandrel, it is turned counter-clockwise to loosen it and then slipped off.



Turning the mandrell clockwise and giving the ring a quick twist in the same direction will cause the roller to lock it to the mandrel

Device for Checking Shoulder Distance

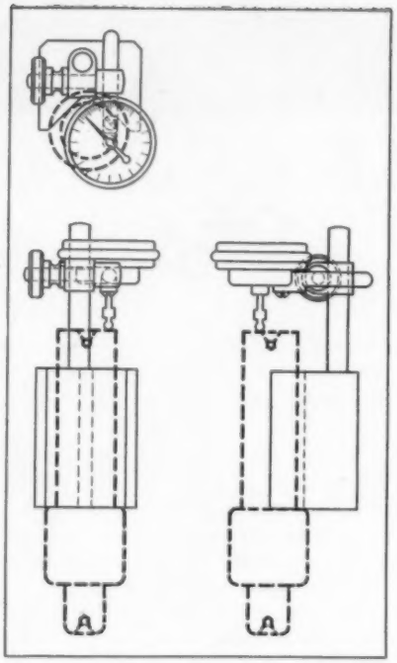
JOHN W. GERDEL

We had to make a lot of core pins for molds for casting aluminum pistons and the specifications called for limits of plus 0.001 in. minus 0.000 in. in the distance between the shoulders and the ends.

The distance was checked by a dial indicator adjustably mounted on a stud in one end of a V-block, the V-block being held vertically on the body of a pin with its lower end resting on the shoulder while the indicator spindle was in contact with the upper end of the pin, as shown in the illustration. The edges of the groove at the lower end of the V-block were slightly chamfered so that a possible fillet where the shoulders of the pin joined the bodies would not prevent the V-block from seating properly on the shoulders. The indicator was initially set to Johansson blocks on a surface plate, the dial being set to zero.

The pins were made slightly longer than called for by the blueprint so that if a shoulder on one of the pins would be inadvertently faced too far from the end, the error could be rectified by facing the end.

In operation, after roughing out the pins, the compound rest was set parallel with the ways of the lathe and a trial cut was taken on the shoulder of a pin, after which it was taken out of the lathe and the shoulder distance was measured. Noting the number of thousandths the indicator pointer moved past zero, the compound rest was advanced the same amount and the finish cut was taken. The measurements made with this device were just as accurate and were made more quickly than with a micrometer depth gage.



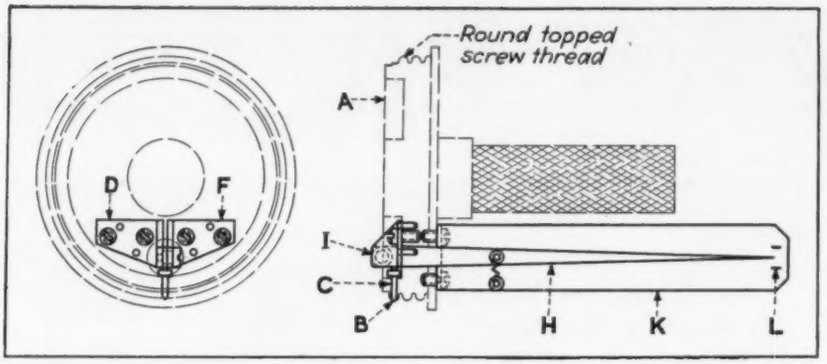
The shoulder distance was checked by a dial indicator adjustably mounted on the end of a V-block held vertically on the body of a pin

An Indicating Thread Gage

JOHN A. HONEGGER

The writer found it necessary to check the major diameter of the rounded internal thread on a pressure-type connection to make sure that the minimum wall thickness between the major diameter of the internal thread and the outside diameter of the pressure vessel was sufficient to withstand any bursting stresses that might be set up in the vessel.

To accomplish this the Go gage illustrated was annularly recessed at *A*, while at *B*, just at the very crown of the rounded thread, a hole was drilled in which the hardened pin *C* was slidably fitted. In recess *A* were screwed and doweled two bearing plates *D* and *F* for the indicator lever *H* which was suspended be-



The gage is provided with an indicator for checking the major diameter of the thread and other important items in relation to wall thickness

tween the plates by the pivot stud *I*. The ratio between the free end of the indicator lever and the pin *C* was 32 to 1, giving the free end of the lever a movement of 0.160 in. for each 0.005 in. movement of the pin.

On the under side of the gage was attached the indicator plate *K*, on the lower end of which were inscribed the maximum and minimum limit lines *L*. A spring (not shown) attached to the indicator plate and the lever provided the necessary tension to prevent lost motion between the lever and the sliding pin.

It was not only possible with this gage to check the wall thickness, but to check any eccentricity between the major and minor diameters, and also in which circumferential section such eccentricity, if any, occurred. Any roughness of the thread on the major diameter was checked by oscillations of the lever as the gage was rotated.

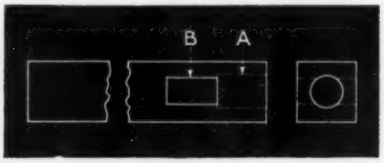
Extension Bar for Taps

MARTIN H. BALL

Where holes to be tapped are in a depression in the work or are so close to a side wall that none of the standard tap wrenches can be used, the extension bar illustrated will be of service.

It consists of a square bar of steel bored at *A* for a close fit on the round shank of the tap and a cross-hole drilled at *B* which is afterward filed or broached to a rectangle to fit opposite sides of the square on the end of the tap shank. Its features are that the round hole fitting the tap shank closely makes it easy to keep both the bar and the tap in alignment with the hole to be tapped; the opposite sides of the rectangular hole bearing on the square end of the tap shank serve to drive the tap.

While the extension bar would make a better appearance if it were made of either round or hexagon stock, it would take longer in the making and the upper end would have to be squared for the wrench.



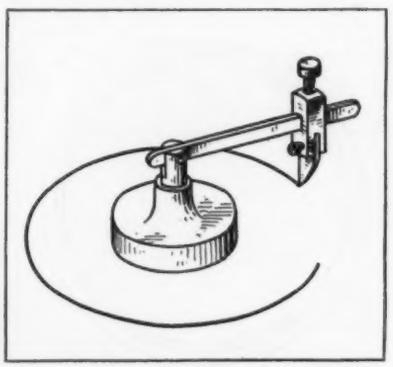
The round hole at the end fits the tap shank closely and opposite sides of the square on the tap shank engage the rectangular hole

Pivoted Disk Cutter

CHARLES H. WILLEY
Superintendent of Manufacturing
Hoyt Electrical Instrument Works

A feature of the disk cutter illustrated is the ease by which the cutter can be lifted out of the cut and moved to the starting position where repeated cuts are necessary.

The radius bar is pivoted to a stud which is revolvably mounted in the top of the base. The cutter head is adjustable on the radius bar for cutting disks of various diameters.



The radius bar is pivoted to its revolvable support so that the cutter can be depressed by hand to cut through the material

In use, the cutter head is adjusted for the diameter of the disk to be cut, and clamped to the radius bar. Then the base is held on the material with one hand and the cutter head swung around and pressed downward with the other.

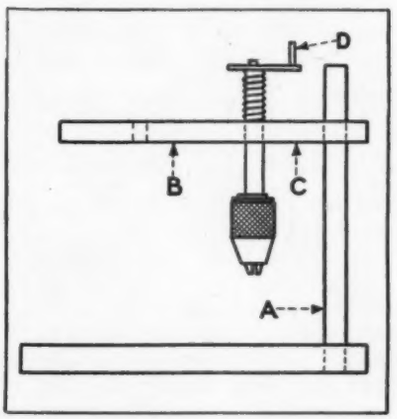
In cutting glass disks, such as crystals for steam and other gages, a rubber disk is cemented to the under side of the base to prevent it from slipping and either a diamond or a wheel substituted for the cutter for softer materials.

Tapping and Reaming Fixture

L. C. MASON
Machine Shop Inspection Department
North American Aviation, Inc.

We have found the illustrated fixture very useful for hand tapping, reaming, burring and countersinking holes of the smaller sizes in small lot jobs. It is of special value in starting taps in holes of welded assemblies that are finished after welding, also in starting taps square with finished faces.

The pillar *A* is square with the base in both directions and the adjustable arm *B* is parallel with the base, which is large enough to accommodate a vise or a V-block and is tapped for hold-down clamps. The arm has several holes for the spindle *C*, each of which has a hardened bushing to fit the spindle and to prevent wear. The lower end of the spindle is fitted with a drill chuck to hold the tools, and at the upper part is a spring to keep it in the upper position when not in use. Crank *D* is attached to the upper end of the spindle above the spring.



Fixtures of this kind placed in convenient points in the shop are useful in tapping, reaming, and countersinking small holes in small lot jobs

Time-Data Sheet No. 19

Milling and Profiling Time Data—III

Continued from Time Data Sheet No. 18 (AM—Vol. 83, page 16)

ANALYSIS—*Continued*

Scope of Formula:

This formula has been made to cover both the horizontal and vertical (profiler) type of milling machines, as there is not sufficient difference in the operation of these machines to warrant a separate formula for each type. Most sections in the East Pittsburgh Works have machines of both types in various sizes.

It is recognized that the time to set up and operate a large machine may be slightly more in some cases than for a smaller machine. However, to avoid complicating the formula, an average time has been used. This has been found to result in sufficiently accurate constants.

Cleaning and Oiling:

Set up and each piece times are increased by 3 per cent to take care of the time spent in cleaning and oiling machines. This percentage was determined from studies of the time required for cleaning and oiling various types and sizes of milling machines. Average time required per day for oiling a machine was found to be 0.130 hr., while the time required to clean a machine (allowed once a week) is 0.40 hr. Total allowed time per week for these operations is: (5 x 0.130) + 0.40, or 1.050 hr. for a 5 day, 40 hr. week. Percentage to be allowed then is: (100 x 1.050) ÷ [(40 x 1.15) — 1.050], or 2.33 per cent. By increasing this allowance to 3 per cent time is allowed for cleaning idle machines when this is necessary.

Classification of Part Sizes:

Part sizes have been classified as follows:

Very small	0–0.50 lb.
Small	0.51–5.0 lb.
Medium	5.1–20.0 lb.
Large	20.1–45.0 lb.
Very large	45.1–75.0 lb.
Jib crane lift	75–2,000 lb.
Overhead crane lift	Over 2,000 lb.

In cases where conditions make the lift hard, it may be necessary to use a jib crane for lifting parts weighing less than 75 lb. Overhead cranes may be used where jib crane lifts are specified and, in some cases, for sizes ordinarily lifted by hand.

PROCEDURE:

Set Up: Get job and drawing, study drawing, make out time slip, get to tool room, get cutters and fixtures, clean table, get clamps, lift vise, angle plate, fixture or index head to table, put on and set cutters, take first piece to inspector, remove cutters, remove clamps, vise, angle plate, fixture or index head.

Each Piece: Pick up piece, place and tighten piece in vise, fixture, index head, angle plate or on table, run up table, engage feed, mill, run table back, release and remove piece from vise, fixture, index head, angle plate or table.

TABLE OF DETAIL OPERATIONS:

Symbol	Description of Operation	Allowed Time Std. Hrs.
	Set-up operations applicable to all jobs:	
A_3	Get job and drawing	0.0500
B_3	Make out time slip	0.0178
D_3	Study drawing for operation	0.0141
E_3	Go to toolroom, get cutters and fixtures, return to machine	0.0865
F_3	Get tools from locker	0.0062
G_3	Gather up and put away tools	0.0070
H_3	Change feed and speed	0.0060
J_3	Clean chips from table	0.0304
K_3	Adjust coolant pipes	0.0072
L_3	Check first piece with inspector	0.0825
M_3	Go to tool rack and get very large fixture with overhead crane	0.0500
	Set-up operations applicable to set up of cutters:	
N_3	Place arbor in milling machine—loosen and remove (includes remove and repace collars and nut)	0.0745
P_3	Place one cutter on arbor and set (includes place collars, nut, arbor support and line up table)	0.0927
Q_3	Place two cutters on arbor and set (includes place collars, nut, arbor support and line up table)	0.2060
R_3	Place three cutters on arbor and set (includes place collars, nut, arbor support and line up table)	0.2861
S_3	Place four cutters on arbor and set (includes place collars, nut, arbor support and line up table)	0.3865
T_3	Remove one cutter from arbor (includes, remove arbor support, nut and collars)	0.0278
U_3	Remove two cutters from arbor (includes, remove arbor support, nut and collars)	0.0370
V_3	Remove three cutters from arbor (includes, remove arbor support, nut and collars)	0.0400
W_3	Remove four cutters from arbor (includes, remove arbor support, nut and collars)	0.0473
X_3	Place additional supports on milling machine and remove (per support)	0.0218
Y_3	Put end mill cutter in milling machine and tighten (includes place cutter on arbor)	0.0320
Z_3	Put cutter in spindle of profiler (includes place cutter on arbor)	0.0320
A_3	Remove end mill cutter from milling machine (includes remove cutter from arbor)	0.0437
B_3	Remove cutter from profiler (includes remove cutter from arbor	0.0528
C_3	Set cutter to work on profiler	0.0092
D_3	Set end mill to work on milling machine	0.0154
E_3	Set trip dogs for table travel or on side of machine	0.0093
F_3	Wipe oil from cutter or saw	0.0050
G_3	Clean cutters, place on storage blocks (cutters in sets)	0.0117
J_3	Put on cutters without collars between (per cutter), such as cutters in sets	0.0050
	Set-up operations applicable to table work:	
K_3	Place small angle plate on table	0.0290
L_3	Place large angle plate on table	0.1235
M_3	Lineup small angle plate and clamp to table	0.0602
N_3	Line up large angle plate and clamp to table	0.1500
P_3	Remove small angle plate	0.0126
Q_3	Remove large angle plate	0.0304
T_3	Get bolt and place in table slot	0.0090
U_3	Get first clamp from locker	0.0170
V_3	Get each additional bolt and clamp from locker	0.0173
	Set-up operations applicable to vise work:	
W_3	Place vise on table and clamp	0.0420
Y_3	Make set up in vise (parallels, shims, clamp, stop, etc.)	0.0403
Z_3	Loosen and remove vise from table	0.0196
A_4	Clean vise	0.0103
	Set-up operations applicable to fixture work:	
B_4	Place small fixture on machine	0.0290
C_4	Place medium fixture on machine	0.0359
D_4	Place large fixture on machine (by hand)	0.0960
E_4	Place very large fixture on machine (by jib crane)	0.1235

Time-Data Sheet No. 20

Milling and Profiling Time Data—IV

F_4	Place fixture on machine (by overhead crane)	0.0450
G_4	Line up fixture and clamp to table	0.0300
K_4	Clean fixture	0.0103
L_4	Remove small fixture from machine	0.0126
M_4	Remove medium fixture from machine	0.0157
N_4	Remove large fixture from machine (by hand)	0.0251
P_4	Remove very large fixture from machine (jib crane)	0.0304
Q_4	Remove fixture from machine (by overhead crane)	0.0165
	Set-up operations applicable to index head:	
R_4	Place index head on table and clamp	0.0599
S_4	Loosen and remove index head from table	0.0150
T_4	Place tailstock on table, tighten and adjust	0.1594
U_4	Loosen and remove tailstock from table	0.0112
V_4	Clean index head	0.0103
W_4	Clean tail stock	0.0103
	Set-up operations for special set ups:	
Y_4	Place C-clamps on bar stock	0.0159
Z_4	Fasten locating block to angle plate	0.0475
	Each-piece operations applicable to all parts in vise, fixture or table:	
H_5	Start machine	0.0006
J_5	Run table forward (per inch or less) by hand	0.0005
K_5	Run table back (per inch or less) by hand	0.0005
L_5	Run table forward with power quick traverse, per inch	0.0003
M_5	Run table back with power quick traverse, per inch	0.0003
P_5	Start cut to profile keyway (feed cutter into work to depth)	0.0170
Q_5	Start cut to mill keyway (feed cutter into work to depth)	0.0110
R_5	Center part in vise, fixture or on table	0.0011
S_5	Engage feed or rapid traverse, table or cross feed	0.0004
T_5	Stop machine	0.0006
V_5	Raise or lower table—set and lock	0.0053
X_5	Raise or lower profiler head	0.0011
Y_5	Set and lock profiler head	0.0033
A_6	Wait on overhead crane	0.0451
B_6	Jib crane lift	0.0250
C_6	Gauge with micrometer	0.0026
D_6	Gauge with snap gauge	0.0013
E_6	Gauge with calipers	0.0013
F_6	Gauge with scale	0.0016
	Each-piece operations applicable to all parts held in fixture:	
C_7	Place very small part in fixture	0.0012
D_7	Place small part in fixture	0.0018
E_7	Place medium part in fixture	0.0036
F_7	Place large part in fixture	0.0052
G_7	Place very large part in fixture (jib crane)	0.0352
H_7	Put locating pin in fixture	0.0018
J_7	Remove locating pin from fixture	0.0028
K_7	Tighten locating screw by hand	0.0023
L_7	Release locating screw by hand	0.0009
M_7	Tighten locating screw with wrench	0.0035
N_7	Release locating screw with wrench	0.0018
P_7	Tighten thumb nut by hand	0.0008
Q_7	Release thumb nut by hand	0.0005
R_7	Open and close cover (hinged)	0.0008
S_7	Remove very small part from fixture	0.0008
T_7	Remove small part from fixture	0.0013
U_7	Remove medium part from fixture	0.0025
V_7	Remove large part from fixture	0.0039
W_7	Remove very large part from fixture (jib crane)	0.0427
X_7	Clean chips from fixture	0.0030
Y_7	Set cutters to set piece, when two operations are performed at the same time	0.0046
K_8	Set and tighten clamp (clamp already in place)	0.0035
L_8	Release and move clamp aside (clamp already in place)	0.0024
M_8	Place on clamp, set and tighten (clamp and nut put on complete)	0.0076
N_8	Release and remove clamp (clamp and nut removed complete)	0.0040
Q_8	Place very large part in fixture (by hand)	0.0088
R_8	Remove very large part in fixture (by hand)	0.0064
	Each-piece operations applicable to all parts held in vise:	
J_9	Clean vise with brush	0.0020
K_9	Place very small part in vise	0.0008
L_9	Place small part in vise	0.0013
M_9	Place medium part in vise	0.0025
N_9	Place large part in vise	0.0039
Q_9	Tighten vise with rawhide mallet and hammer part	0.0031
R_9	Release vise (rawhide mallet)	0.0012
V_9	Remove and lay aside very small part	0.0005
W_9	Remove and lay aside small part	0.0010
X_9	Remove and lay aside medium part	0.0019
Y_9	Remove and lay aside large part	0.0030
Z_9	Move bar stock forward in vise	0.0019
	Each-piece operations applicable to parts set up on table:	
A_0	Brush chips to clean table	0.0020
B_0	Place small part on table	0.0013
C_0	Place medium part on table	0.0025
D_0	Place large part on table	0.0039
E_0	Place and remove very large part from table (jib crane)	0.0622
F_0	Remove and lay aside small part from table	0.0010
G_0	Remove and lay aside medium part from table	0.0019
H_0	Remove and lay aside large part from table	0.0030
K_0	Set and tighten clamp (clamp already in place)	0.0035
L_0	Release and move clamp aside (clamp already in place)	0.0024
M_0	Place and clamp, set and tighten (clamps and nut put on complete)	0.0076
N_0	Release and remove clamp (clamps and nut removed complete)	0.0040
P_0	Line up and set part with cutter, where set up will not repeat	0.0163
S_0	Set jack (per jack)	0.0021
T_0	Shim part	0.0081
U_0	Line up job with scale	0.0015
V_0	Line up small part with surface gauge	0.0090
W_0	Line up medium part with surface gauge	0.0150
X_0	Line up large part with surface gauge	0.0310
Y_0	Line up small part with square	0.0060
Z_0	Line up medium part with square	0.0120
A_1	Line up large part with square	0.0290
B_1	Line up small part with level	0.0110
C_1	Line up medium part with level	0.0200
D_1	Line up large part with level	0.0350
G_1	Place very large part on table (by hand)	0.0064
H_1	Remove very large part from table (by hand)	0.0051
	Each-piece operations applicable to parts set up on index head:	
K_1	Get part	0.0008
L_1	Index or turn index head	0.0048
M_1	Place part in chuck	0.0007
N_1	Put dog on small, medium or large part	0.0014
P_1	Place part between centers and adjust	0.0042
Q_1	Remove part from between centers	0.0022
R_1	Remove dog	0.0014
S_1	Lay aside part	0.0008
T_1	Place part in chuck and on tail stock	0.0014
U_1	Center (tighten chuck and adjust center)	0.0030
V_1	Remove part from chuck and center, lay aside	0.0022
W_1	Tighten chuck	0.0019
X_1	Release chuck	0.0018
Y_1	Remove and lay aside	0.0018

(To be continued in an early issue.)

THE ARSENALS IN ACTION

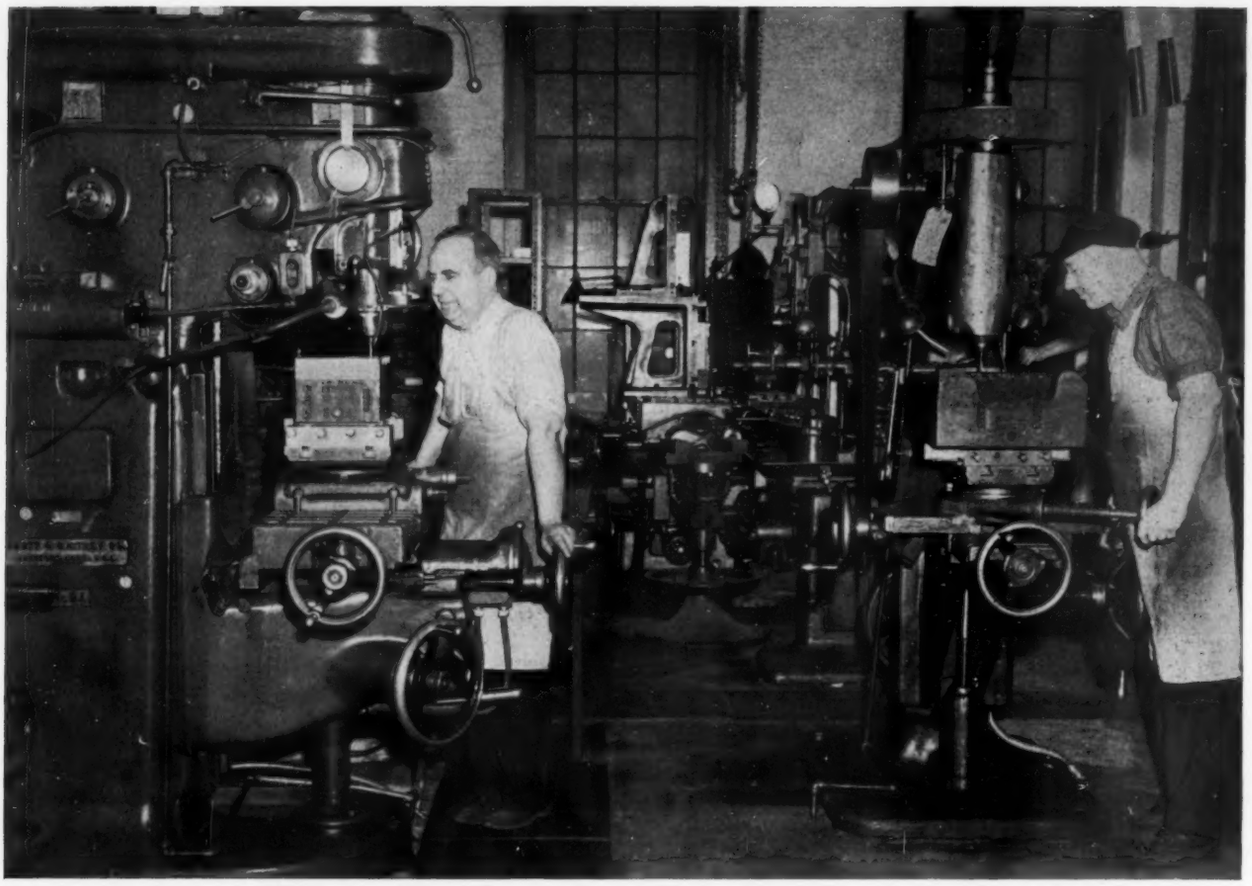
"Modern war takes its character from the age in which we live—the machine age. It is a war of men, and it is a war of machines. Without the men, the machines are useless. Without the machines, the men are helpless."—*The Ramparts We Watch,* George Fielding Eliot.

Watertown's assembly shop is well suited for work on large coast defense guns

WAR HAS EVER BEEN a conflict involving men and materials. Courage, intelligence and a firm conviction in the righteousness of one's cause are as vital today as at any time in history.

These admirable attributes are of little help to an unarmed man facing an enemy with a machine gun. An army is dependent on materials, and because of the mechanized nature of modern warfare, these materials have rapidly increased in importance. Some of the things an army needs, such as shirts and shoes, trucks and tents, are made during peace time by private industry. Others, comprising the munitions of war, are peculiar to conflict and would not be made during peace time unless special provision were made for their manufacture.

In 1776, Col. Henry Knox, one of General Washington's commanders, recommended "that there shall be one or more capital laboratories erected at a distance from the seat of war in which shall be prepared a large quantity of ordnance stores of every species and description. That at the same place a sufficient number of able ar-



A modern P. & W. die sinker far outstrips the same type of machine built by the same maker 50 years ago

tificers be employed to make carriages for cannon, of all sorts and sizes, ammunition wagons, tumbrils, harnesses, etc., etc. That as contiguous as possible to this place, a foundry for casting brass, cannon, mortars, howitzers be established upon a large scale."

The logic of Col. Knox's recommendation found favor, led to the founding of Springfield Armory and eventually to the present chain of Army Arsenals. Though the instruments of warfare have changed greatly since Revolutionary days, the necessity for established sources of supply is today as urgent as ever.

It is obvious that any future war will be fought by industry behind the lines as well as by guns at the front. The manufacturing arsenals are the Army's industry. It is true that they will not supply the Army's entire ordnance needs even in peace time; in time of war, privately owned plants must take over about 90 per cent of the load; for some types of munitions industry's contribution is even higher.

Such a set-up is based on sound economy and common sense. It would be a terrific addition to the country's tax burden to maintain the arsenals on a basis that would enable them to fill wartime needs.

The Arsenals have several vital functions. One is to develop new army ordnance equipment; another is to serve as pilot plants so that in the event of an emergency, they can quickly guide industry into efficient wartime production.

To fill these functions adequately certain conditions must be observed. The arsenals, in time of peace, must be kept in a state of preparedness. They can no more be neglected than can a battleship be allowed to rest at its moorings.

If the arsenals are to serve as pilot plants, they must be well equipped; otherwise they cannot achieve that leadership in manufacturing technique that will enable them to show industry the way when need arises. It is highly important that procurement of arsenal equipment be done before the emergency becomes a reality. If this is done, the arsenals can at once be stepped up to full capacity; equipment makers will be free to supply private plants without the heavy burden of filling high priority government orders; and arsenal personnel can at once step into its rôle of technical leadership in outside sources of munition supply.

Unfortunately these theories of arsenal activity have never completely functioned in the past. Our military policy is subjected to political considerations and to alternate waves of pacifism and alarm on the part of the public at large.

If the average American were asked to operate a 1919 model automobile he would strenuously object. He would point out that the car would fail in an emergency and that maintenance costs would be exorbitant. Yet so far as the arsenals are concerned, the citizens of the United States have often shown as little foresight as that involved in driving a 20-year-old jallopy.

Too often have we repaired the roof after it had started to rain. We re-equip our arsenals after war has been declared.

We started the World War with Civil War equipment in our arsenals. Today a high percentage of arsenal equipment dates back to the World War and earlier.

Despite meager appropriations, the arsenals have done a fine service in developing new munitions. It can be

A major caliber railway-mount gun leaves Watertown Arsenal to undergo test

safely said that progress in this direction is equal to that of any nation and superior to most. But to a great extent their equipment is so old they cannot assure their full function as pilot plants.

These old machines are expensive to operate; their cost of maintenance is high. Replacement by modern efficient units would in a great many instances reflect a net saving in overall ordnance operation.

One does not have to be an ordnance officer nor an expert in machine work to visualize the accuracy required in manufacturing most ordnance material. An anti-aircraft gun, for example, is ineffective unless the breech block, recoil mechanism and trunnions are all machined to limits held within thousandths of an inch.

All the manufacturing arsenals must work to such fine tolerances. With antiquated equipment the process is slow and painful—and very expensive.

Modern machine tools have the required precision; they also have centralized controls so the operator can guide his machine from a position where he can watch the work in progress. They have power traverse to all heavy tool heads and work carriages; they have safety interlocks so one operating function cannot interfere with another and wreck the equipment.

To a great extent the arsenals today would again face World War conditions, where they were kept so busy modernizing and expanding that it took them a period of many precious months to reach peak production. Steps are now being taken to remedy this shortcoming. These steps should be accelerated to make up for the long deferred modernization.

The pages that follow give a brief glimpse into the six manufacturing arsenals. They tell of the many constructive things the arsenals are doing and also of some of the facilities which they lack. It is hoped that these descriptions will serve to emphasize the arsenals' key position in national defense and the necessity of equipping them to do their work well.

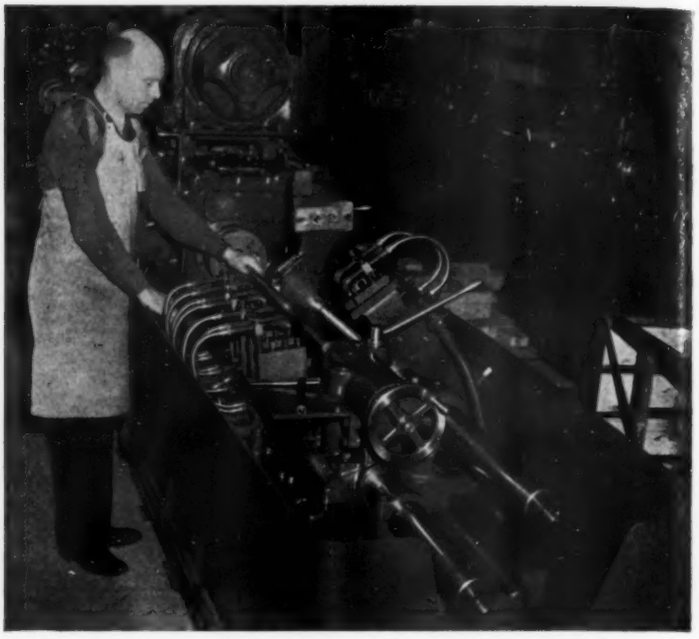
THE ARSENALS AND INDUSTRY

By MAJOR GENERAL C. M. WESSON
Chief of Ordnance, U. S. Army

The manufacturing Arsenals of the Ordnance Department have a historic link to the metal-working industry. When machine tool construction was in its infancy, arsenal personnel made many contributions toward improving methods. Interchangeable manufacture was first applied to the U. S. Army rifles. The museum at the Springfield Armory still displays the gun stock lathe designed by Thomas Blanchard in 1822 when he was employed there. Today the arsenals carry forward this tradition in a constant effort to advance the processes of precise machining and fine metal finishing.

These forward steps are made only through full cooperation with industrial organizations, particularly the equipment manufacturers. The interchange of technical data and experience between outside suppliers and ordnance personnel has been particularly gratifying; without it many of our advances in the art of munitions making would not have been possible. Because of the increased variety and complexity of present day metal-working methods this mutual helpfulness is needed today as never before. I am counting on it to put our manufacturing arsenals on a more efficient footing.

An old cone-pulley driver Cowdrey lathe has seen years of service turning out rifle barrels; this is one of a battery that is beyond the age of efficient production



In contrast with the old barrel turning machinery is this modern Fay automatic lathe; multiple cutters on front and rear tool carriages meet production requirements

SPRINGFIELD IS FAMOUS FOR ITS RIFLES

SPRINGFIELD ARMORY is the oldest of the Army's arms-producing units. Started in 1777 as a source of munitions for the infant republic, it was made a national institution in 1794. This latter date is prominent on the front corner of the Hill Shop, one of Springfield's two main plants. The Water Shop about a mile away was built around the same time.

Springfield manufactures complete rifles; it makes parts for pistols, machine guns and other small arms. Until recently the Springfield M 1903 rifle has been the Army standard, and it is still used by most of the regular Army and National Guard. The new U. S. caliber .30, M 1 rifle, sometimes called the Garand, is a semi-automatic which is now standard equipment. It has about three times the firing speed of the old Springfield and greater accuracy because of its low recoil. It is an ideal weapon for an infantry trained in firing at a target.

Springfield, while still engaged in making parts for the M 1903, is now equipping and tooling for the M 1 rifle. A modern product stimulates the adoption of modern methods, and with increased appropriations available, the changeover is timely. $1,800,000 has been allotted for this purpose.

Early history shows that the Armory filled its part admirably in blazing the trail of advanced methods. Some of the important innovations in metal-working were developed here. As a consequence, Springfield proved invaluable to the Union during the Civil War. By 1865 the production of muskets had been stepped up to well over a quarter million.

Buying Is Spasmodic

After this date, stagnation set in. During the 30-year period between 1865 and 1894, only eighteen new pieces of equipment were acquired. A slight flurry of modernization during the Spanish-American war was followed by another period of dormancy. Then 800 machine tools were installed during the World War. Only four new units were added during the decade between 1925 and 1934 when the recent program of equipment replacement was inaugurated.

A rifle is necessarily a light portable mechanism, capable of withstanding high internal stresses. A large number of irregularly shaped small parts must function smoothly and rapidly under this severe service. Machining tolerances must be held within narrow limits. Since the product is standardized, it lends itself to mass production methods, providing precision equipment is available.

Most of the old equipment at Springfield is inadequate for this purpose. It is driven by narrow belts which slip under heavy cuts. Gears and spindles are often badly worn which causes chatter and rough surfaces unless slow speeds and light feeds are used. Hand oiling in most cases provides insufficient protection against wear. Much of this equipment is so old that the extensive repairs needed to put it in good shape would not be warranted.

In addition, these antiquated machines do not embody the improved methods that have been developed for mass production. Multiple cutting tools and rapid return motions between cuts, which have received so much attention in modern machine tools, are entirely absent in the older units. The range of feeds and speeds, and facilities for adjusting work fixtures and tool heads, are not available to afford the most desirable conditions for removing metal.

STANDARD MACHINES INSTALLED IN SHOPS OF SPRINGFIELD ARMORY

Type of Machine	1849 1854	1855 1859	1860 1864	1865 1869	1870 1875	1875 1879	1880 1885	1885 1889	1890 1894	1895 1899	1900 1905	1905 1909	1910 1915	1915 1919	1920 1925	1925 1929	1930 1934	1935 1939	Total
Broaching Machines																		3	3
Chambering, Gun Barrel										3	2			7				2	14
Drilling, Horizontal														39					39
Filing Machines													3			1		2	6
Grinders					1				1		4	4		48	10			44	112
Hammers, Drop													1	20				5	26
Lathes			3	2	1				3	2	10	2		65	12			50	150
Millers			1		2		1			2	6	1	5	293	44			61	416
Planers, Metal											1				1				2
Presses, Drill			4	1						1	1		5	119	1			37	169
Presses, Punch								1		2	2	1	3	29	2			7	47
Profilers, Wood	6		10									1		4	1				22
Profilers, Metal										3	10			105	5			19	142
Reaming, Horizontal, Barrel														14	2				16
Rifling Machines, Barrel										5	29							1	35
Saws, Buzz & Rip, Wood		2							1		1	2	5	1				7	19
Screw Machines, Automatic														12			3	18	33
Screw Machines, Hand														12	3				15
Shapers, Metal											1			15	1			5	22
Shaving Machines, Upright														10	11				21
Splining Machines											7			1					8
Turning Machines, Wood		3	9	1	2		1			2	3	6		6	3			1	37
Total	**6**	**5**	**27**	**4**	**6**		**2**	**1**	**5**	**20**	**77**	**17**	**22**	**880**	**96**	**1**	**3**	**262**	**1,354**
Percentage	**0.45**	**0.37**	**1.99**	**0.30**	**0.45**		**0.15**	**0.07**	**0.37**	**1.48**	**5.68**	**1.25**	**1.62**	**59.08**	**7.09**	**0.08**	**0.22**	**19.35**	**100**

Springfield's need for new equipment is forcibly brought out by the above table. Nearly three-quarters of the machine tools now in use are over 20 years old; until the recent replacement program modern machines were practically non-existent

Rifle barrel drilling must still be performed on old equipment such as this although machines of improved design are available

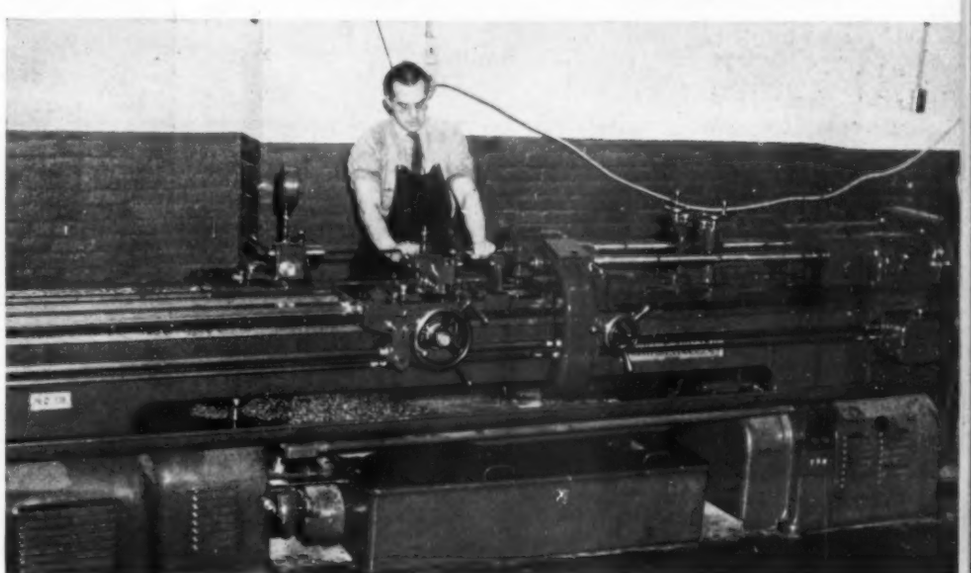
Broaching, for example, is applicable to many operations and will be used more widely when new equipment is procured. These needs are recognized and will be supplied by the current modernization program.

Old Buildings Inadequate

Springfield is also handicapped as to buildings. It can well be imagined that 1794 structures, even when kept in repair, are just as obsolete as old style machinery. Stair wells and passageways are dark; windows are narrow; machines must often be placed with an eye to the floor loads rather than according to an arrangement for most efficient production. Facilities for material handling are subject to the inherent nature of the housing.

Despite these limitations Springfield Armory is going ahead with a well considered program for the manufacture of the new rifle. Up-to-date turning and drilling equipment has already been installed for work on rifle barrels. Profiling, milling and drilling machines are being replaced for operations on the smaller parts. These new units as yet are not sufficient in number to eliminate dependence on the obsolete equipment. The present modernization activity must be extended to replace those machines which are incapable of combining speed with precision.

This is the first modern double-spindle rifle drilling machine to be installed at Springfield. Such units pay for themselves in time saving and improved product



WATERVLIET MAKES THE ARMY'S BIG GUNS

FROM THE Dutch word for "flowing waters" Watervliet takes its name. The arsenal was built in 1813, second in age only to Springfield Armory. None of the original buildings is still standing, but some now in use date back to 1840. One building of this vintage is constructed of cast iron.

The old Erie Canal ditch runs through the arsenal property. At the time it was built, the commanding officer wrote to Washington expressing his pleasure that the problem of arsenal transportation had been settled for all time. Today the dry ditch gives evidence of the fact that no problem is settled for all time, else there would be no need for armaments or arsenals.

Watervliet Arsenal is the gun factory of the ordnance department. It does all the work for the Army on major caliber gun barrels and the final operations on 3-in. gun barrels. All breech mechanisms are made here.

Only two of the arsenal's buildings are used as workshops—the remainder are used for storage or are kept in stand-by condition. The seacoast cannon shop, which houses machines for operations on the major caliber guns, is 1300 ft. long with 200,000 sq. ft. of ground area. It dates back to 1890, and much of its equipment is of the Spanish-American War era.

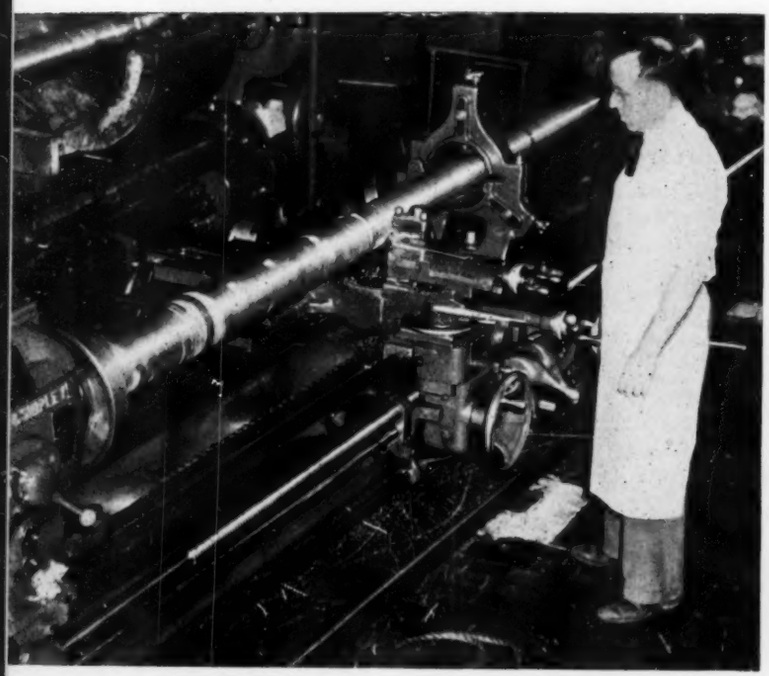
Because of the large size of the work and the special nature of the operations, this building contains many unusual construction features. Gun boring requires a machine twice the length of the work itself; as these machines are placed across the building, ample width has been provided with headstocks placed between building columns. Drives on some of these machines have been modernized by eliminating old two-voltage system motors.

For shrinking hoops on the gun tubes and inserting the liners, deep vertical furnaces and assembly pits are needed. These extend some 125 ft. below the floor level—in fact below the level of the nearby Hudson River, so that two pumps are needed to remove the seepage. Furnaces have been improved by the installation of electric heating elements to assure close temperature control. In handling large gun components to and from the furnace pits, corresponding head room and crane service has been provided. Despite its age the building is still well adapted for its purpose.

The boring and turning lathes are mounted on heavy concrete foundations over shale soil. Major caliber guns are bored and reamed by wood packed tools. These operations apply to the liners, the tube and the hoops which make up the barrel assembly.

Wood-packed tools consist of boring or reaming heads followed by a long cylindrical guide of selected maple. The wood follower eliminates chatter in the tool, keeps the bore straight, and since it is a few thousandths larger than the setting of the cutters, it has a burnishing action on the surface. The disadvantage of the process is the high maintenance cost on the wood packing which cannot be used for more than one gun. Wear and tear on the wood limits the speed of the operation. The method is an old one, but nothing better has been found which will give the required results.

Watervliet is now making the first major caliber guns in 20 years. Only six men in the shop have done this work before so the order comes in time to take advantage of their experience and to train new men.



Modern machines such as this have the speed and rigidity to permit the use of carbide tools on turning the outside diameter of an anti-aircraft gun liner

Gun bore honing is a recent development which removes some of the skill formerly required for reaming. Changes like this make it easier to employ new men

A saw-tooth shop, built during the World War, houses operations on breeches and 3-in. anti-aircraft barrels.

A good amount of new equipment has been installed in this shop. Several Lodge and Shipley lathes have been acquired for turning 3-in. gun barrels using carbide tools. New reaming equipment has been added for gun liners.

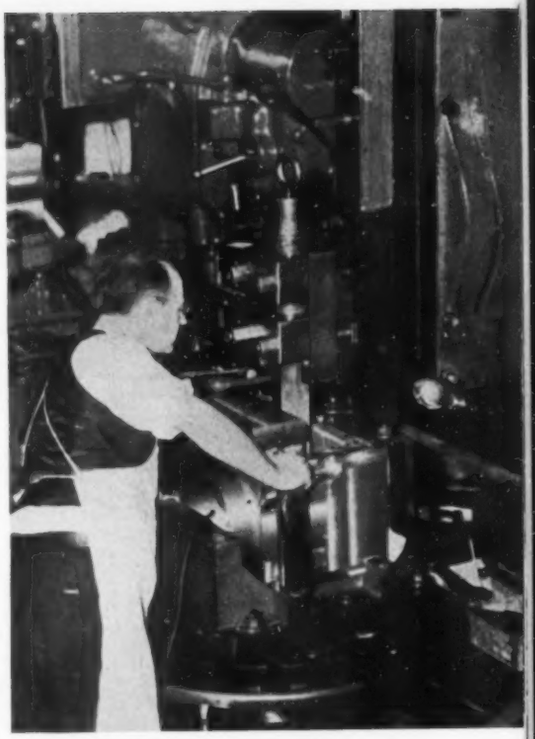
A battery of modern milling machines is now at work on breech blocks and a Keller automatic does work in the irregular 3-in. breech block extraction path.

Many other improvements have been made, but an additional expenditure of $1,600,000 is needed to make the job complete. More honing equipment is needed. Broaching machines both internal and external can be employed to advantage on many operations. Other requirements include turret lathes, surface grinders and thread milling machines.

AGE OF MACHINE TOOLS AT WATERVLIET ARSENAL

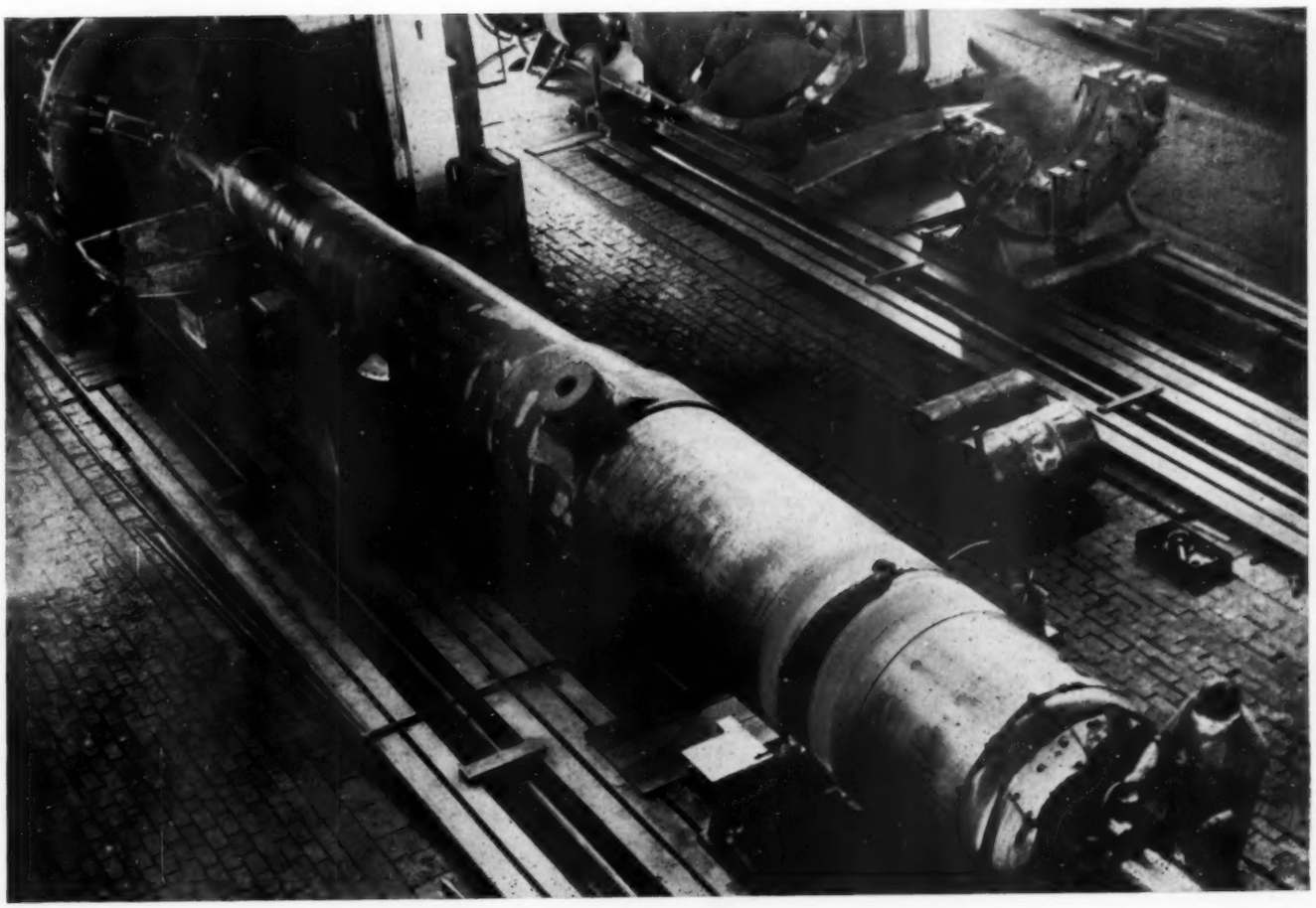
	CURRENT SERVICE		STANDBY	
	1–5 Years	Over 20 Years	Over 20 Years	Total Machines
Boring, Drilling & Milling Machines, Horizontal	8	31	45	84
Boring Machines, Vertical	..	5	30	35
Drilling Machines, Vertical & Radial	10	22	87	119
Grinders, Cylindrical & Internal	3	20	79	102
Grinders, Surface (all types)	17	7	13	37
Lathes, Boring	4	29	66	99
Lathes, Engine	14	88*	254	356
Milling Machines, Horizontal (Plain & Universal)	10	26	145	181
Milling Machines, Special (including Profilers)	8	14	41	63
Milling Machines, Vertical (standard types only)	9	17	64	90
Planers	..	13	27	40
Rifling Machines	..	5	13	18
Shapers, Horizontal	2	24	51	77
Shapers, Vertical & Slotters	5	11	28	44
Turret Lathes	14	8	30	52
Total	104	320	973	1,397
Per Cent	7.4	22.9	69.7	

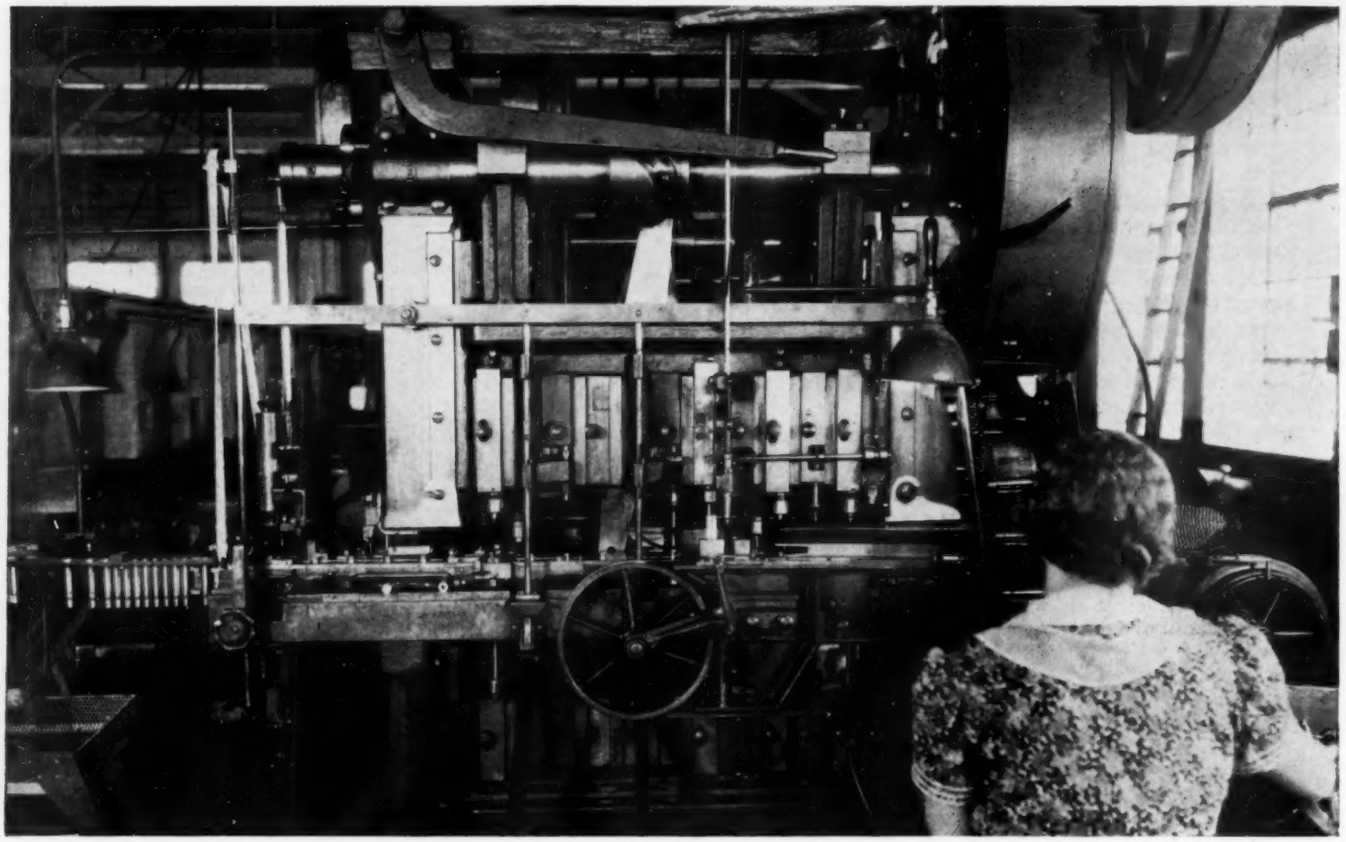
* Includes nine machines completely rebuilt.
Virtually no equipment is between five and twenty years old.



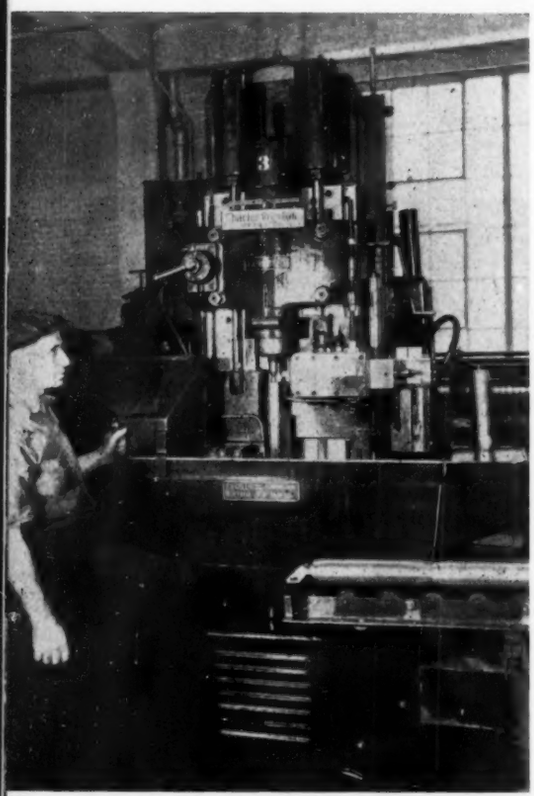
A 14-in. slotter is at work on a breech block slide surface. Smaller blocks lend themselves to broaching and will be machined in this way when equipment has been procured

Big lathes like this still serve for boring and rifling major caliber guns. The work illustrated is on a 12-in. cannon which has been relined





This machine receives the primer and shell from feed hoppers and assembles them automatically



Artillery shells are turned in an Ex-Cell-O vertical lathe; one tool is fed up, another down, by hydraulic pistons

FRANKFORD SUPPLIES

THE SITE OF Frankford Arsenal was part of a tract sold in 1742 by John Penn, grandson of William Penn, to Andrew Hamilton for one shilling per 100 acres. Since the site covers 91 acres its cost at that time was less than a shilling.

The arsenal was begun in 1816. Its chief period of expansion was during the Civil War when the present small arms ammunition factory, ammunition storehouse, blacksmith shop, tin shop and machine shop were constructed. Frankford is really three arsenals at one location. Except for centralized administration and procurement offices, each division operates independently.

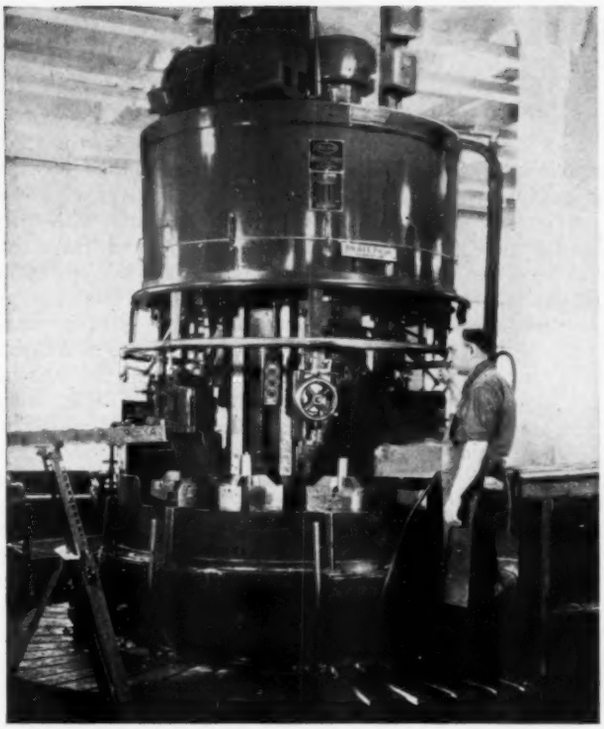
The products of Frankford Arsenal are (1) small arms ammunition (2) artillery ammunition, and (3) instruments.

The small arms ammunition division operates on a mass production basis. Concentrating, as it does, on a few types and sizes of ammunition it has developed an efficient and specialized set-up for the purpose. In its particular field it has no direct competition from private industry. The four largest outside makers of cartridges are concerned chiefly with sports ammunition; with the exception of the caliber .22 shell their output is so diversified that they cannot employ specialized machines to their fullest degree.

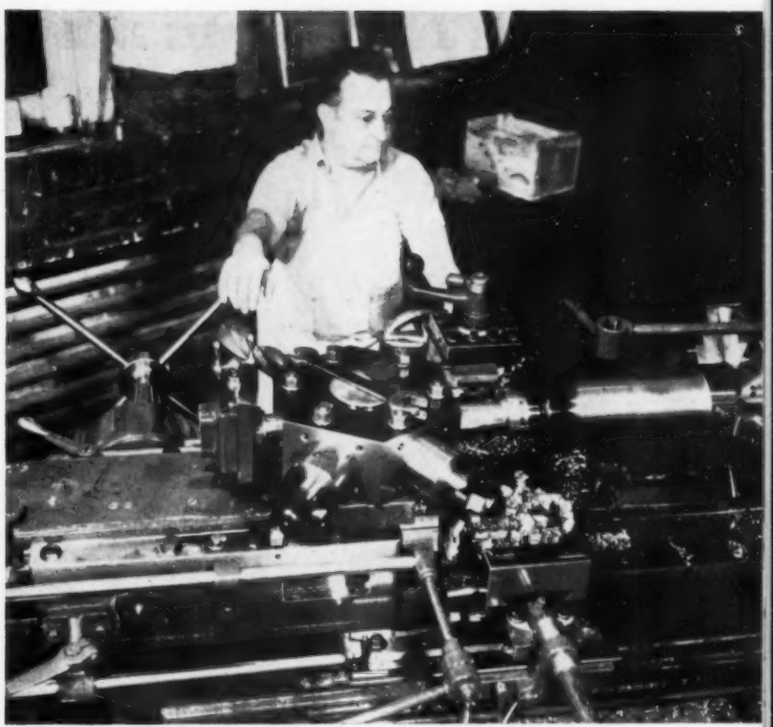
In wartime, vast quantities of small arms ammunition are needed; even by expanding to war capacity Frankford could supply only a small percentage of the quantity needed. During peace time some 100,000,000 rounds are required annually for test and target purposes alone.

Manufacturing departments in the small arms ammunition division suffer from old and cramped quarters. This handicap is being relieved somewhat by a current $1,000,000 modernization program which will segregate the caliber .50 from the caliber .30 cartridges.

The bulk of the equipment in this division is old. Since it is highly specialized and since it lacks the yard-



A Bullard machine performs facing and recessing operations on 75-mm. shells which are indexed automatically



An operation on the fuze setter was expedited by a well planned tooling set-up on a Warner & Swasey turret lathe

AMMUNITION AND INSTRUMENTS

stick of outside competition it is difficult to say just how much of it should be replaced. Certainly the expenditures to date will furnish only a small part of the equipment needed.

In the preparation of primers, and in priming and loading the cases, the explosive puts a limit on the speed of operation. In these departments the use of faster machinery depends on the preliminary installation of air conditioning to maintain the powder at the desired temperature and humidity.

In the purely mechanical operations there is room for considerable modernization. For drawing shell cases, most of the equipment consists of old crank presses. Ram speeds are variable and depend on the limitations of crank motion. Experiments are being conducted with a view toward improving the equipment including the possible use of hydraulic presses. It is entirely possible that the drawing of caliber .30 cases could be done in four steps instead of five, as at present, by the use of optimum speeds. The saving would be reflected in annealing and cleaning between draws as well as in press operation and tooling.

Artillery ammunition is manufactured only so far as mechanical parts are concerned; priming and firing charges are added at Picatinny Arsenal. This division includes a special section devoted to the manufacture of mechanical time fuzes.

Manufacturing buildings used by this division were for the most part built in 1918. Their metal-working equipment represents the greatest advance that has been made in any arsenal activity and is the result of a $2,250,000 expenditure over the past two years.

Six sizes of shells are now being made, but for each size there are several different types. Continuous line manufacture is employed, using up-to-date equipment that reflects careful planning.

Material-handling equipment has been well worked out in the shell shop with gravity conveyors between machining operations and overhead conveyors to bring the blanks from the forge shop and to return them for heat-treatment.

The case shop reflects a like degree of progress with new hydraulic presses for forming operations and automatic equipment employed wherever possible. The artillery ammunitions division's modernization program, while not entirely complete, is well advanced.

The instrument division works chiefly on fire-control apparatus; in addition it supervises purchases of equipment of this kind from outside suppliers. The work is of wide variety and until recently, lots were so small that they could be handled only on a job shop basis; even now there are many one-time experimental orders.

Machine tools used in the instrument division are of standard design, but many of them are now obsolete. Recent additions include new turret lathes, engine lathes, profilers, horizontal boring machines, a Heald Borematic, milling machines and grinders. A new turret lathe set-up has reduced an eight-hour operation on the fuze setter to one hour. This is an outstanding example, but many other sizable savings can be realized by further modernization. The high precision required in this work is another reason for the acquisition of up-to-date machine tools.

WATERTOWN WORKS ON SEACOAST DEFENSE AND ANTI-AIRCRAFT GUNS

SEVEN OF THE buildings still in use at Watertown Arsenal are part of the original construction completed in 1820. The site had been selected and purchased four years prior to this date.

Originally established as a depot for the storage, repair and issue of small arms and for the manufacture of small arms cartridges, Watertown was soon equipped for larger work and became the Army's factory for coast-defense guns.

This activity continues to the present day and includes 8 to 16 in. barbettes and railway carriage mounts; a recent addition is the 3-in. anti-aircraft gun. Watertown makes the mounts and roughs out the 3-in. gun barrels. The rest of the work on the barrels is done at Watervliet.

Watertown is essentially a jobbing shop, handling medium sized and heavy work. With the exception of the large gun lathes at Watervliet, the Watertown Arsenal has the largest machine tool equipment of any of the Army's manufacturing establishments. Units of this size are not stocked by the builders and cannot be procured quickly even in time of peace. A year at least is needed to buy and install some of the larger equipment, and this delivery may be greatly extended when machine tool builders' shops are busy.

Long deliveries on heavy equipment must be remembered in planning for preparedness at Watertown. Also important is the fact that nearly 85 per cent of Watertown's equipment is over *eighteen* years old. A comparison with private industry is obtained from the fact that *American Machinist's* 1935 Inventory of Metal-Working Equipment showed 65 per cent of machine tools to be over *ten* years old.

As the accompanying list shows, there are many units at Watertown dating back over 40 years, and one bolt machine is over 60 years old. A few typical examples are described briefly:

A 48-year old Putnam lathe is used on the top carriage of the 3-in. anti-aircraft gun and on cylinders for the 16-in. gun. Originally

AGE DISTRIBUTION OF MACHINE TOOLS AT WATERTOWN

NAME	TOTAL	1-6 Years	19 Years	20 Years	Over 20 Years
BORING MACHINES					
Floor Boring Mills	17	1	3	2	11
Trunion Turning	4	..	..	..	4
Horizontal Boring	43	8	7	9	19
Portable Boring	12	..	..	..	12
Vertical Boring	24	1	..	13	10
CUTTING MACHINES					
Abrasive Cutting	2	2	..	..	..
Bolt Cutting	3	..	..	1	2
Hack Saw (Power)	15	6	..	4	5
Pipe Machine	4	1	..	..	3
Shear	7	2	..	3	2
Cold Saw	13	1	1	4	7
DRILLING MACHINES					
Centering Drill	5	..	2	2	1
Deep Hole Drill	2	..	..	2	..
Multiple Spindle	6	2	1	..	3
Radial Drill	47	2	4	10	31
Sensitive Drill	20	5	1	1	13
Vertical Drill	22	..	..	9	13
GRINDING MACHINES					
Bench Grinder	8	4	..	3	1
Cylinder Grinder	18	3	7	4	4
Gage Grinder	1	1	..	..	..
Hob Grinding Machine	1	1	..	..	..
Cutter & Drill Grinder	13	9	..	2	2
Lapping Machine	4	2	..	..	2
Polishing Machine	10	7	..	..	3
Rotary Surface Grinder	1	1	..	..	..
Surface Grinder	6	2	..	2	2
Tool Grinder	17	3	..	5	9
Saw Grinder	2	1	..	..	1
Pedestal Grinder	8	8	..	..	..
Portable Grinder	1	1	..	..	..
Tool Post Grinder	13	..	1	1	11
LATHES					
Boring Lathe	45	2	2	16	25
Engine Lathe	209	10	2	49	148
Bench Lathe	11	10	..	..	1
Turret Lathe	15	7	..	1	7
Auto. Screw Machine	3	3	..	..	..
Vertical Turret	8	1	..	7	..
MILLING MACHINES					
Portable Milling	1	..	..	..	1
Filing Miller	5	..	..	4	1
Gear Miller	3	2	..	..	1
Miller Horizontal	49	5	4	15	25
Duplex Spline Miller	1	1	..	..	..
Slab Miller	14	..	..	7	7
Thread Miller	6	2	..	2	2
Vertical Miller	20	4	..	10	6
PLANING MACHINES					
Broaching Machine	1	1	..	..	..
Bevel Gear Planer	5	3	..	1	1
Vertical Keyseater	1	1	..	..	..
Planers	80	4	7	31	38
Shaper	28	3	1	4	20
Hydraulic Shaper	3	3	..	..	..
Slotter	26	2	..	7	17
Rifling Machine	1	..	1	..	..
GRAND TOTALS	885	138	44	231	472
PER CENT	100.00	15.60	4.97	26.10	53.33

NOTE: 84.40 per cent of all machines 19 years or older.

NOTE: No machine tools procured between 1920 to 1932. Many of the machines listed as over 20 years old, are far older, but in some cases there is no record of their age. However, a few are listed below:

NAME	DATE PURCHASED
Floor Boring Mill, Niles	1895
Floor Boring Mill, Niles	1893
Boring Mill, Beaman Smith	1905
Boring Mill, Niles Bement Pond	1905
Vertical Boring Mill, Niles	1894
Vertical Boring Mill, Niles	1892
Portable Boring Mill, Niles, Bement & Pond	1905
Bolt Machine, National	1894
Bolt Machine, Acme	1878
Cold Saw, Newton	1894
Sensitive Drill, Washburn	1905
Vertical Drill, Snyder	1907
Engine Lathe, Pond	1893
Engine Lathe, Putnam	1890
Engine Lathe, Reed	1911
Engine Lathe, Niles Bement Pond	1905
Gear Miller, Gould & Eberhardt	1893
Gear Planer, Gleason	1907
Planer, Niles	1896
Planer, Pond	1893
Planer, Niles	1894
Planer, Detrick & Harvey	1893
Planer, Detrick & Harvey	1895
Traveling Head Shaper, Warren	1905
Slotter, Niles, Bement & Pond	1905

a 60-in. lathe, it has been raised on blocks to swing 72-in., which gives it increased vibration and chatter. It has no feed-gear box, and threading can be done only by pick-off gears; no taper attachment and no micrometer collars. All drive gearing is open and unprotected. Formerly this machine was used for the 3-in. AA gun pedestal. A new LeBland lathe with spherical turning attachment has reduced time on this operation from 24 to 8 hours. Other work now being done on the old machine could be performed on modern equipment with savings of a third to a half.

A 46-year old Niles vertical boring mill machines 8-in. cradles and similar work. Although it is a huge machine, swinging over 20 ft., it has no power traverse to the rams or saddles. Feed changes are obtained by pick-off gears and a rubber friction disk. The disk slips under heavy cuts, especially when it wears flat, which it does frequently. The table gearing is so worn that the machine has to be run backward on the opposite face of the teeth to get a passable finishing cut.

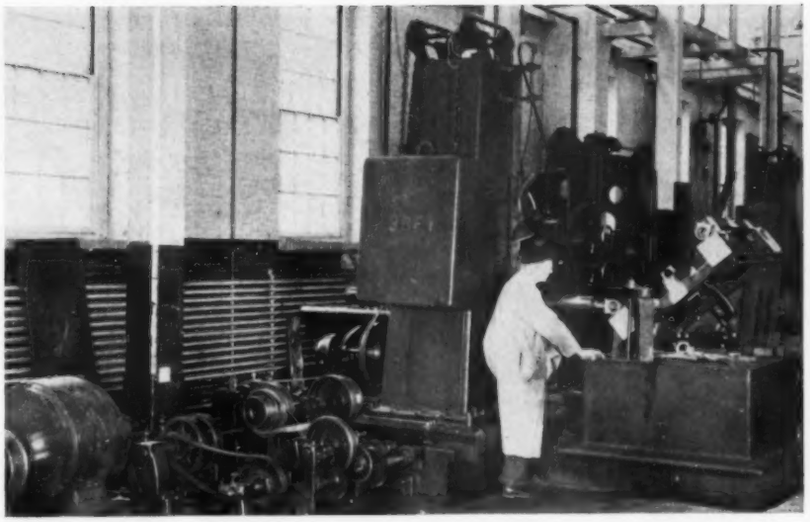
A 45-year old Pond planer machines angles and brackets on the 16-in. gun shield. Originally belt driven, it has been changed at the arsenal to reversing motor drive. It has only hand traverse for the heads and hand clamping for the crossrail. It will take 60-in. work between the housings. The table is 20 ft. long, but because of a bad twist in the bed, it can be used only for short work. The expensive overhaul required to rehabilitate this machine would not be justified.

So much for the bad news. The fifteen per cent of new equipment has been selected to good advantage and gives an indication of the progress that can be made. An erecting shop built during the world war is excellently suited to its purpose.

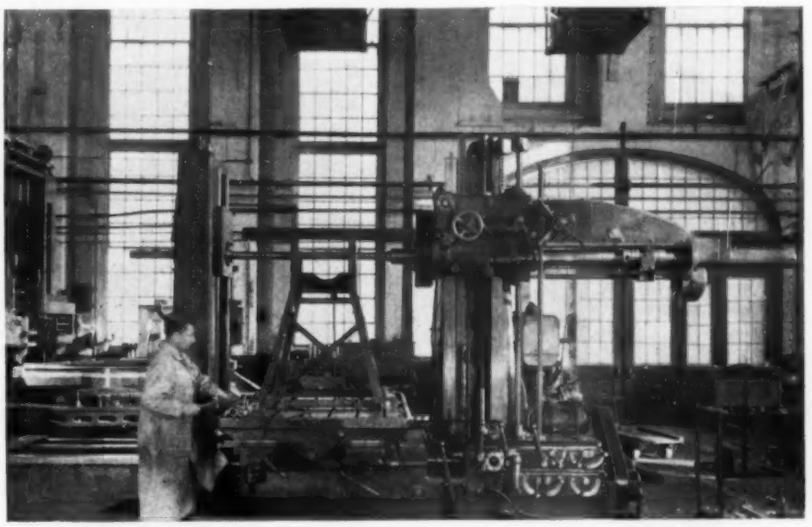
Watertown has pioneered the welded fabrication of gun mounts. It has fine equipment for the purpose, including modern positioners for holding the work and new furnaces for stress relieving the welded structures.

A new American lathe for boring and turning 3-in. AA gun barrels takes only a third of the time required by older equipment. A Universal horizontal boring machine and a King vertical boring mill give an opportunity for the use of carbide cutting tools, for which the old equipment lacks speed and rigidity.

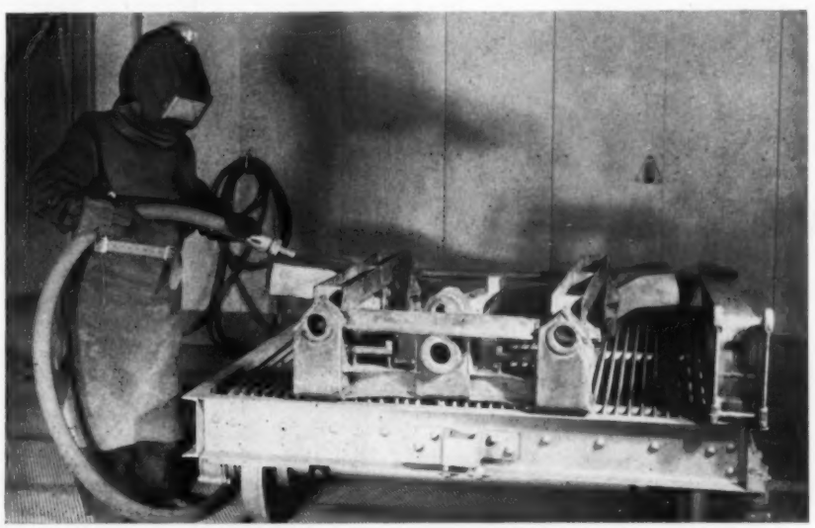
Watertown has made a good start, but much remains to be done.



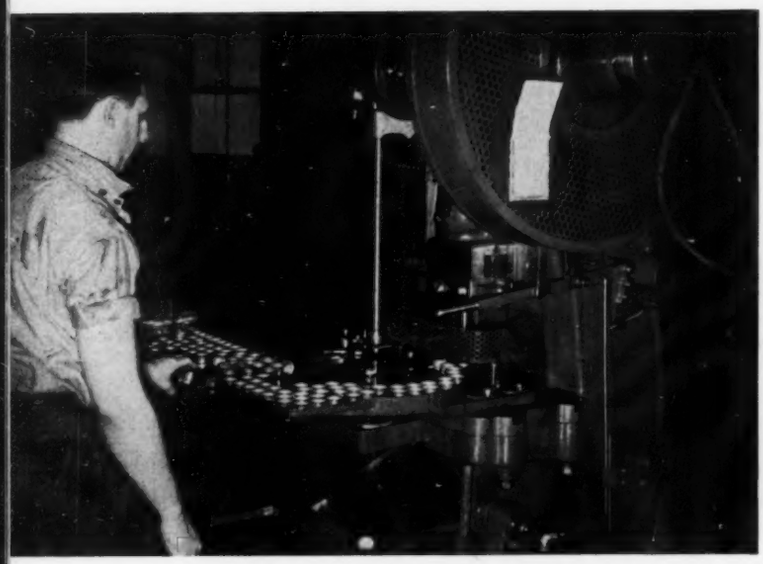
This 33-year old machine with its open gearing on the floor takes double the floor space and double the time of a modern horizontal boring mill



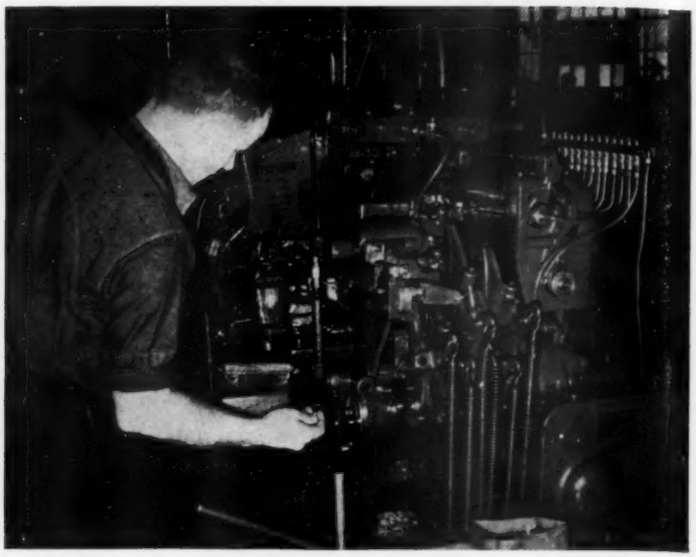
Contrasted with the machine shown above is this new Universal boring mill, the only modern machine in this building. Such equipment is worked to capacity



Among the modern developments at Watertown is the extensive use of welding on gun mounts. Illustrated is an up-to-date sand-blast room for cleaning components after fabrication

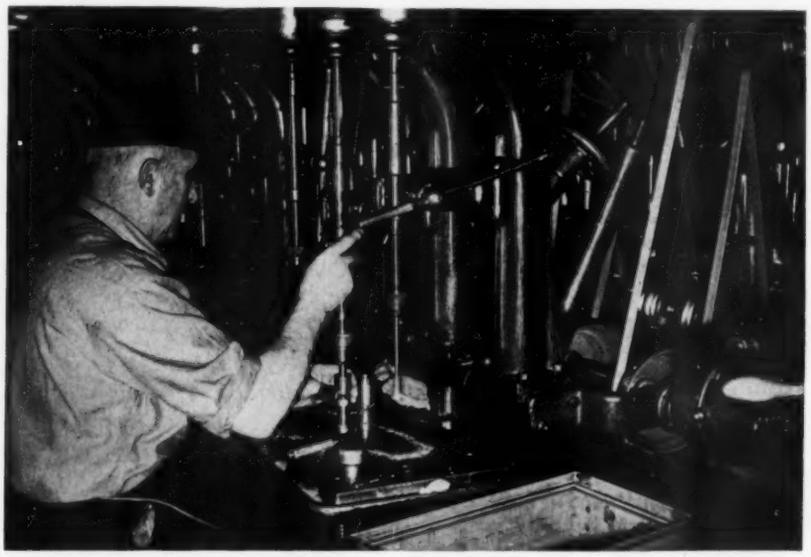


Fuze sealing caps are given a second drawing operation in a Standard press equipped with dial feed

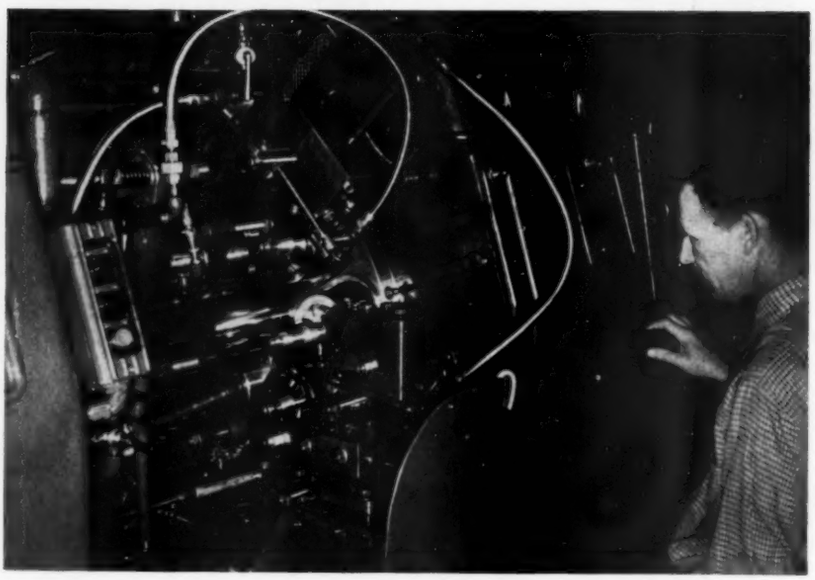


One of two new Davenports at work on a fuze interrupter shows the application of automatics to long runs

These old style drill presses are typical of the obsolete machines at Picatinny slated for replacement

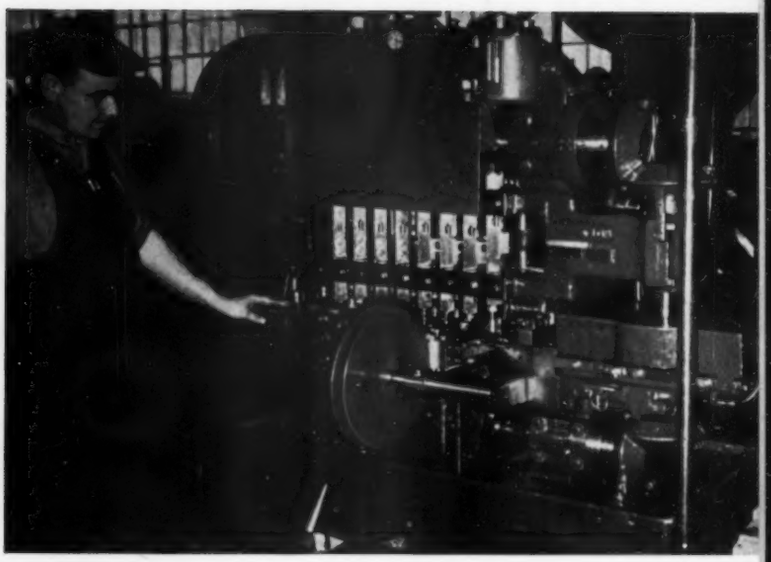


Artillery fuze bodies are drilled automatically in a new Kingsbury multi-station drilling machine



Where quantities warrant, automatic machines such as this National Acme can be used to advantage; the work shown is a bomb fuze body

A multiple fixture is set up on a Milwaukee mill for cutting slots in three bomb fuze bodies at one setting



A Waterbury-Farrel eyelet press performs progressive operations on a fuze support cup

PICATINNY MANUFACTURES POWDER AND LOADS SHELLS

WHILE ONLY 39 miles from New York City, Picatinny is isolated. It occupies a valley one mile wide and three and a half miles long in a sparsely populated section of northern New Jersey. The arsenal was founded in 1880, and the powder plant was added in 1907.

Powder plant operation is essentially a chemical process guided by a well equipped laboratory for research on explosives. The explosive area contains, in addition, the loading plant, where fuzes are given their detonating and firing charges, and the complete rounds are assembled with fuzes, firing charges and explosive charges. All of this work is conducted in small buildings spaced some 500 ft. apart for safety.

In 1926 an explosion on the adjoining Lake Denmark Naval Ammunition Depot damaged most of the buildings on the reservation. The rehabilitation program which followed has left the Arsenal buildings in good condition.

Shell loading consists largely of hand operations. Small presses, drilling machines, crimping machines and similar light equipment make up the greater part of the limited number of light machine units used. Studies are being made toward mechanizing this work, but because of the hazardous materials handled, progress is necessarily on a conservative basis.

Metal-working operations are mostly confined to the Metal Components Division, which manufactures the mechanical parts for detonating fuzes outside the explosive area. The shop for this work was built in 1926; it is a one-story building with a main bay and three wings well suited for its requirements.

A fuze is a precision mechanism which must function accurately after having been struck a terrific blow. It contains safety latches to prevent its operation until actually fired from a gun, and these must work surely and well. To assure these functions, all its parts must be machined to extremely close limits, and all burrs must be carefully removed. If the fuze does not operate as it should, all the expense of fire-control, the shell itself and the efforts of the gun crew are wasted.

Lot sizes vary from small pilot orders to quantities running into hundreds of thousands on a few standard types. The Division is set up as a jobbing shop with like kinds of machines grouped together. When large lots are ordered, it is often found expedient to move certain equipment into a manufacturing group for quantity production.

Many of the machine tools were bought when the building was built; others were brought in from standby stocks of other arsenals. This latter equipment is now too old for the service called for and is being replaced by units of up-to-date design.

Among the modern machines recently acquired are two Davenport automatic lathes, two National Acme automatics, two Standard presses with automatic feed, a Waterbury-Farrel eyelet press, several Warner & Swasey turret lathes, a Milwaukee milling machine and a Kingsbury drilling machine. As quantities required are increasing, more automatic machinery is needed and the remaining old equipment should be replaced. An expenditure of $100,000 would enable this Division to step up production considerably.

In a separate building, a department has been provided for tin and cadmium plating together with the needed cleaning equipment. A centrifugal drier here would be of value in handling the many small parts which go through this department.

After fuzes are loaded samples are put through the "rumble-jumble". This arrangement consists of a jarring machine and a wooden tumbling barrel.

The room is sealed and the machines are operated by remote control for a specified number of cycles. After being rumbled and jumbled successfully, the fuzes are broken down and examined for defects. It is easy to see they must be carefully made to pass this severe test, but because of it, safe operation in service is assured.

MACHINE TOOLS AND EQUIPMENT REQUIRED FOR MODERNIZATION AT ROCK ISLAND ARSENAL

1. The following equipment has been determined as necessary to modernize completely the Machine Shop at Rock Island Arsenal:

40—Automatics
28—Boring Mills
1—Jig Borer
6—Broaching Machines
3—Dieing Machines
67—Drilling Machines
155—Grinders
9—Hobbers
17—Honing Machines
127—Lathes
104—Milling Machines
27—Planers
32—Presses
6—Profilers
14—Power Saws
31—Shapers
4—Die Sinkers
8—Slotters
4—Tapping Machines

Fifty additional items of machine shop equipment, including shears, riveters, welders, and hardening furnaces.

2. Among the more important items needed in the forge and hydraulic press shops are:

11—Forging Furnaces
3—Gap Presses
6—Hydraulic Presses
1—Straight Side Press
7—Steam Drop Hammers
3—Trimming Presses
2—Forging Machines

Miscellaneous items such as manipulators, welders, panels, brakes, slip roll, and cutting machines.

3. Due to extra power load, the electrical department will need additional transformer and bus equipment, and increased capacity in feeder distribution system. A larger telephone exchange is already necessary.

4. The oldest equipment at Rock Island Arsenal is located in the Carpenter Shop, where requirements include fourteen new machines.

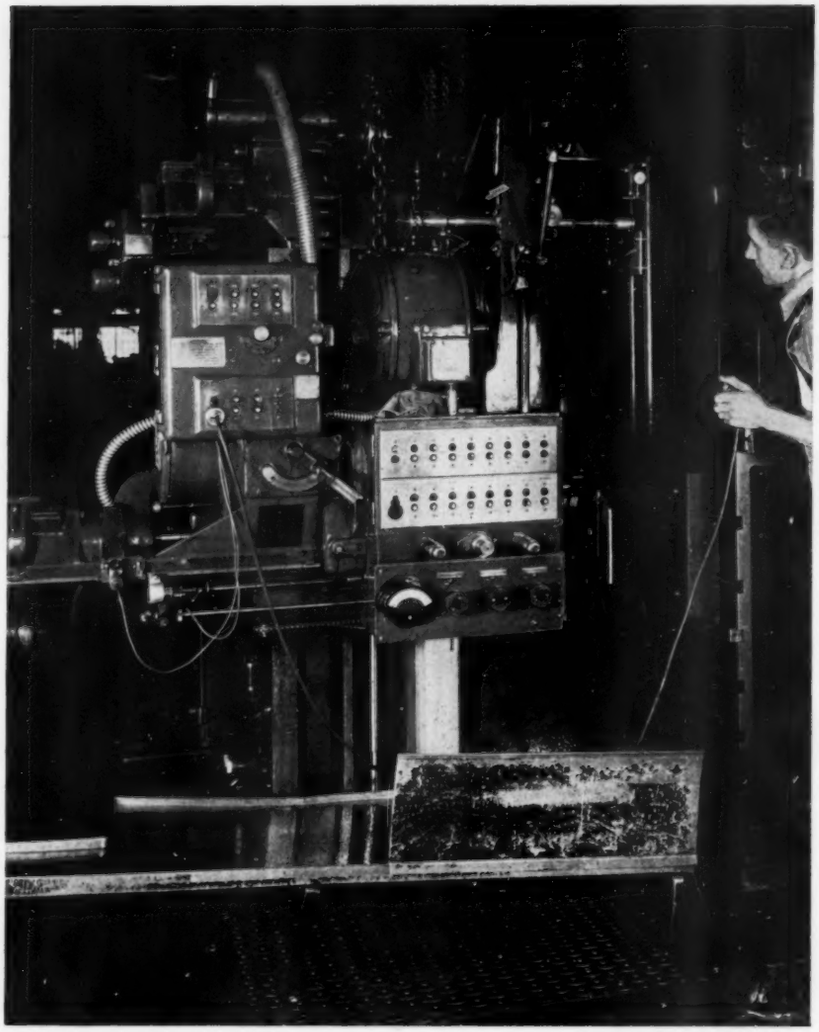
5. Among the items needed in the foundry are two furnaces and a core oven.

6. The production of the cloth and leather shop can be greatly increased by the use of additional machinery. During the past twenty years, there has been a gradual tendency to replace hand work by mechanical methods. Among the items needed in this shop are 44 sewing machines and eleven other items of leather working equipment.

7. The modernization of the Armory will require approximately 121 various machines: 5 drop hammers, 10 furnaces, 5 forging presses; in addition to other necessary equipment.

8. The necessary laboratory equipment includes 50 items. Among these are:

1—Macro Laboratory Camera
4—Fatigue Machines
2—Oscillators
3—Furnaces
10—Testing machines



Several of the arsenals have found it expedient to use automatic die-sinking machines on regular production. Irregularly shaped parts can be readily machined in this way by following a simple master templet

ROCK ISLAND

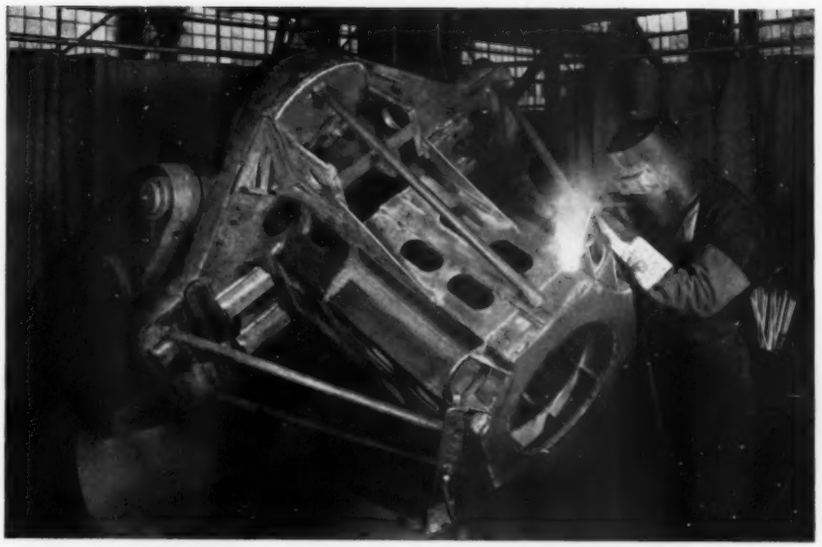
LAST YEAR Rock Island Arsenal celebrated its 75th birthday. Strategically located on a 900-acre island south of the main channel in the Mississippi River it forms the largest unit of ordnance manufacture.

The Arsenal is devoted largely to work on mounts for light and medium artillery, and on automotive equipment which consists chiefly of tanks and armored cars. The work includes both the modernization of old equipment and the building of new equipment. A great deal has been done in high-speeding the mounts on older types of artillery. Old wooden spoked wheels are removed and replaced with disk or wire wheels; pneumatic tires are employed where suitable; anti-friction bearings are used in many positions; electric and hydraulic brakes are added. In much the same manner older tanks are brought up-to-date by appropriate alterations.

Rock Island operates on a basis between the engineering manufacture at Watertown and the mass production at Frankford, although, at present, some of the work at Watertown and Rock Island, such as anti-aircraft mounts, is identical.

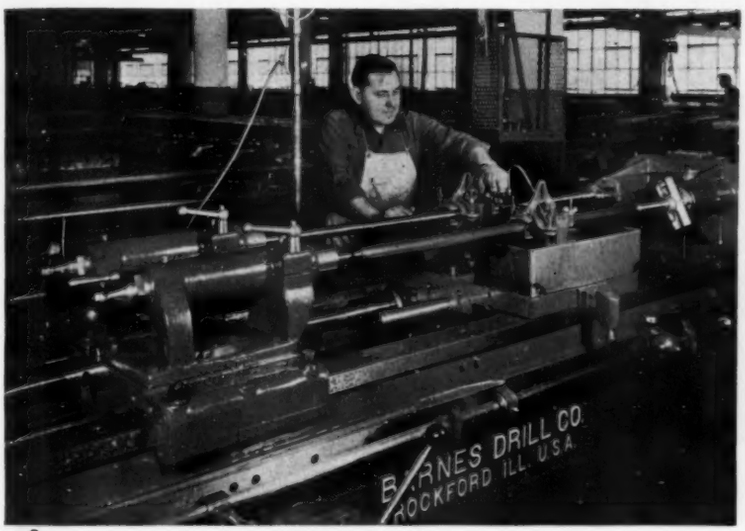
Rock Island has a number of advantages. From a military standpoint its middle western location is good. It has plenty of land on which to expand. While some of its buildings are 75 years old it has a good number of newer buildings built during the World War. These newer build-

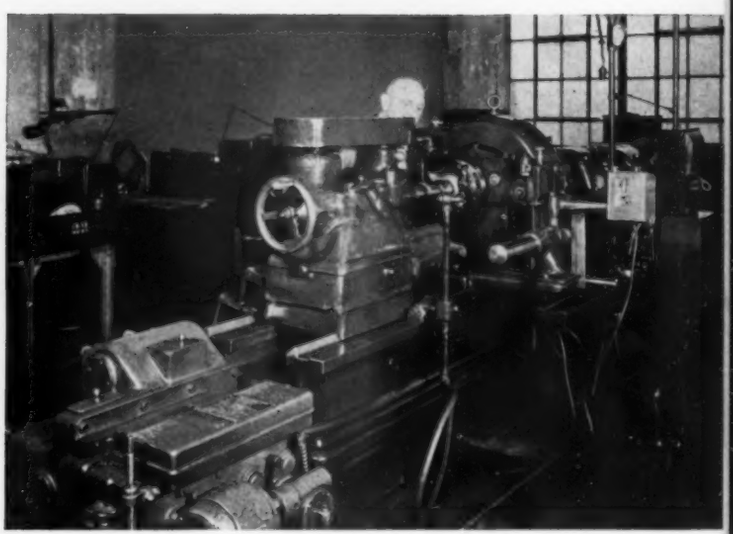
Rock Island has ten such positioners which enable the welder to work with the electrode above the bead. Time is saved by the elimination of awkward working angles and a better weld results



External honing has been developed for the rods in the recuperator mechanism by Rock Island in co-operation with the machine tool builder. This double-head machine is the last word in fine finishing

Cylindrical cams are cut by this electrically controlled Monarch-Keller lathe with a milling attachment. Parts like this are used for gun carriage loading mechanisms and are tedious to make by older methods





BUILDS TANKS AND GUN MOUNTS

ings are in general well suited to manufacturing work. Their concrete floors are ample for heavy machine loads. They have good head room and natural lighting. Elevators are well placed and stair wells are wide.

One war-time building of monitor construction serves as a welding shop. Until last year old machinery was stored here, but this has been cleaned out and a modern plant installed. In lightening the gun carriages, welded fabrication has been widely used, and Rock Island is well able to show private industry some things about welding practice. Equipment in the shop consists of a National flame cutting machine, ten positioners (United and Ransome), a Surface Combustion 10x20-ft. hearth car-bottom furnace for stress relieving and two shot blast units (Sly and Pangborn) for cleaning. A constant potential generator has been installed to supply the entire building. Bus bars carry current up the center of the structure to all arc welding outfits and are designed to take additional units.

The machine tool equipment is, as in other arsenals, a combination of the old and the new. Rock Island has developed methods as well as products. Outstanding in this direction is its work in horizontal honing both external and internal. These operations are used on the recuperator mechanism.

Another arsenal development has been the application of Keller automatic die-sinking machines to rather unconventional types of work. These machines are used for contouring operations as on the tractor sprockets which can be ganged to cut five at a time. Other irregular shapes are handled in the same manner from simple patterns often in less time than a man could lay out the work for a conventional milling cut.

For cylindrical cam cutting, such as the cams for carriage loading mechanisms, a Monarch Keller lathe equipped with a special milling head is used. For trunnion turning a special Kearney and Trecker machine has been installed. This machine is double ended and equipped to take a wide range of trunnions without special fixtures. Optical sights with

cross hairlines on the two heads afford a means of aligning them with a high degree of accuracy.

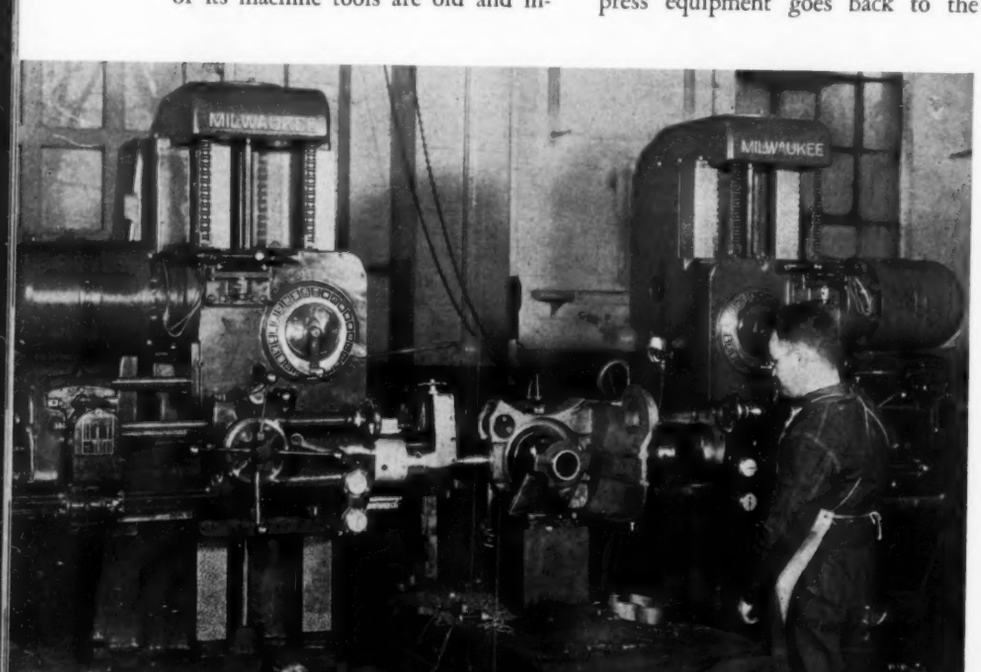
Rock Island could do still more if it had additional modern equipment. In considering some of the good things the Arsenal is doing it should be remembered that the greater part of its machine tools are old and incapable of present day speed and accuracy.

The carpenter shop badly needs equipment since nothing here has been done in the way of modernization. One wood turning lathe has served since 1875.

Some of the slitting, shearing and press equipment goes back to the Spanish-American War and earlier. A 24-in. Putnam lathe has seen service since 1899; a Gould & Eberhardt gear milling machine was installed the same year. To put Rock Island's equipment on a thoroughly modern basis will require an expenditure of approximately $7,500,000.

Rock Island has considerable equipment in standby condition. There is a rifle plant, for example, that was shut down in 1911, started up during the war and shut down after the Armistice. The machines are carefully slushed. Most of them have sample parts on them. They are tagged with the operation, name of the part, name of the operator and name of the man who ground the tools.

During the decade following the World War such stand-by and stored equipment might have had a real emergency use. Today practically all of it could be scrapped with little loss. Indeed such a move would serve to clear the picture of arsenal capacity, for the value of this equipment, even as a reserve, has long since vanished.



A special trunnion turning machine, shown here on the 3 in. anti-aircraft gun mount, can be used on a wide variety of work. Each spindle head carries a telescopic positioner which insures that both spindles are accurately in line at each setting

WHAT THE ARSENALS SHOULD HAVE

Appropriations sufficient to modernize their equipment so they can serve as pilot plants for industry

A policy of equipment amortization that will justify a continuing machinery replacement program

Consideration of the advisability of new manufacturing facilities in new locations with modern buildings

Expansion of training programs to include supervisory personnel as well as shop workers

PROCUREMENT DATES OF MACHINE TOOLS IN SHOP M, ROCK ISLAND ARSENAL

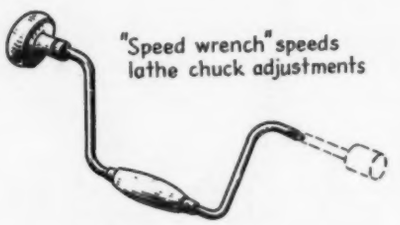
	To 1900	1901 to 1905	1906 to 1910	1911 to 1915	1916 to 1920	1921 to 1925	1926 to 1930	1931 to 1935	1936 to date	TOTAL
Engine Lathes	2	8	2	1	136	..	..	..	..	148
Turret Lathes	..	1	..	..	7	..	..	..	..	8
Bench Lathes	..	1	..	1	16	..	..	..	..	18
Automatic Lathes	..	..	..	..	1	..	..	..	..	1
Grinding Machines	2	11	3	1	169	1	2	13	12	214
Milling Machines	..	6	2	4	152	..	..	9	..	173
Vertical Drills	..	..	..	2	94	..	..	4	..	100
Horizontal Drills	..	..	..	..	9	..	..	..	..	9
Radial Drills	..	..	..	2	17	..	..	..	..	19
Multiple Drills	..	..	..	..	4	..	..	..	..	4
Die Sinkers	..	..	..	..	1	..	..	4	1	6
Shapers	..	3	..	..	43	..	..	..	1	47
Planers	..	7	..	..	34	..	..	..	..	41
Slotters	..	..	..	..	13	..	..	1	..	14
Horizontal Borers	..	..	2	1	17	..	..	6	..	26
Vertical Mills	..	..	..	..	3	..	1	..	..	4
Jig Borers	..	..	..	..	..	..	1	1	1	3
Gear Cutters	1	1	..	1	12	..	..	6	2	23
Broaching Machines	..	..	..	..	2	..	..	2	..	4
Lapping Machines	..	..	..	..	17	..	2	2	4	25
Presses	4	4	..	4	52	..	..	5	6	75
Punch and Shears	2	..	..	4	4	..	1	..	1	12
Forging Hammers	1	..	..	2	9	..	..	..	..	12
Welding Machines	..	1	..	1	2	..	..	1	..	5
TOTAL	12	43	9	24	814	1	7	54	27	991
PER CENT	1.2	4.4	0.9	2.4	82.1	0.1	0.7	5.5	2.7	

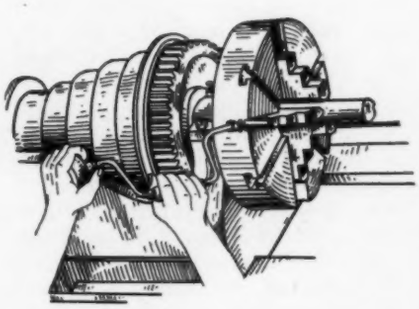
Less than nine per cent of this equipment has been acquired since the World War.

SHORT CUTS FOR THE SMALL SHOP

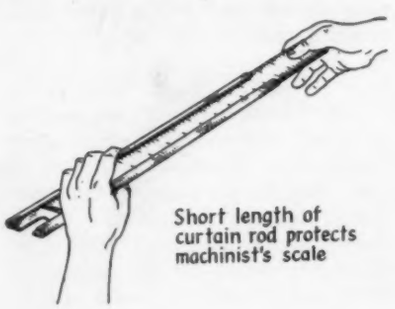
A. H. WAYCHOFF

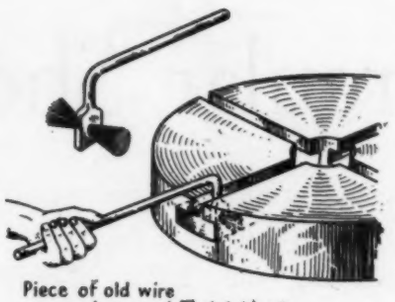
When making long adjustments on lathe chuck jaws, a machinist can save a lot of time by using an old auto speed wrench instead of the usual type of key wrench. Lying around nearly every small shop is one of these crank-type wrenches, possibly with a worn or broken socket, which can be made to suit the purpose with no trouble at all. Simply grind the end down to fit the wrench sockets of the chuck jaws, and you'll save more time with it every day than it took to make in the first place.



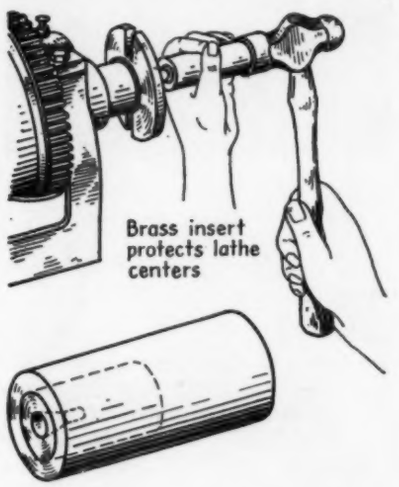


Any shop man who carries a scale around in his tool kit knows how easy it is for the edges to get nicked up, making it practically worthless. This can be prevented by keeping it in a case made from a length of telescoping curtain rod. For rough measurements the scale doesn't have to be removed, as there is enough of the markings showing so that it can be read. At other times it can be easily removed by grasping it through the cut-out sections in either end of the case.



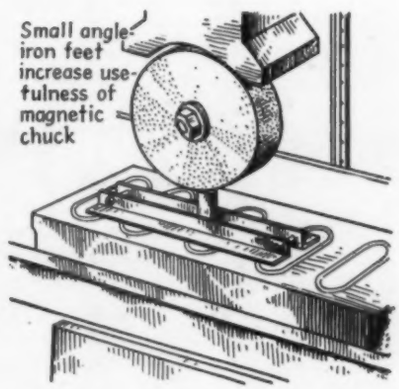


This handy little brush will be found ideal for cleaning out the T-slots in milling machine tables, drill press tables, and the like. Bend a right angle in a bar a little smaller than the narrow part of the slots, and then flatten the short end and drill a hole through it, as shown in the sketch. Next cut off a short length of wire rope and push it through the hole. Then untwist each end of the rope a little, and your brush is ready to use. It will clean the slots without scratching them or marring the side walls, and the "bristles" can always be replaced just by inserting a new length of cable as before.

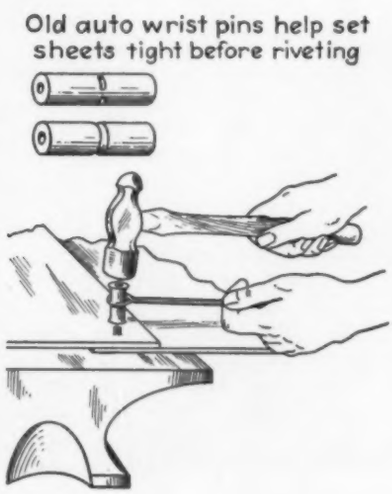


This little trick will be found mighty handy for tapping lathe centers into their sockets without any danger of damage. Just take a brass plug a couple of inches long and about twice the diameter of the center and drill a 60-deg. taper in one end. Then run a small drill farther down it, so the point of the center won't get burred up. Next bore out a small piece of shafting to take the brass plug and keep it from being pounded out of shape, and the gadget's ready for use.

Anyone having a magnetic chuck for his drill press or precision grinder can get a lot more use from it by clamping a couple of angle irons at the bottom of any non-magnetic object to be held by the chuck. In this way, brass, copper, aluminum, and plastics may be firmly gripped for accurate work. The device will also come in mighty handy for holding magnetic pieces that are too slim to be safely held by the chuck alone, such parts often getting away from the chuck and causing wedging, occasional broken wheels, and damage in general.



One machinist doing a lot of sheet metal work has found that old automobile piston wrist pins, which can be picked up around any junk yard, have various sizes of holes through them, and that in his line of work they make mighty good rivet sets. He bends a length of ½-in. rod around the central groove and twists the ends together to make a handle, and uses the pin to set the sheets up tight before he heads the rivets over.



Trimming Dies for Circular Shells

Irregular edges around the open ends of drawn shells are removable in "pinch-off" tools, or in ones utilizing the "balanced-cut" principle

C. W. HINMAN
Tool Engineer
Kobzy Tool & Electric Mfg. Company

WAVED EDGES around the open-end side walls of drawn shells, and the overflow flange or fin on hot- and cold-swaged parts, must be trimmed for the removal of irregular outlines. In brass, zinc, and aluminum castings, and around the contours of drop-forged pieces, a surplus of metal may purposely be allowed for a final trimming operation. Fig. 71 shows a drop-forged connecting rod and the scrap which has been cut off in a trimming die set up in a straight-sided trimming press.

Flash Removal

Most cold-swaged parts must be trimmed. When the body of the part is swaged to size, the surplus metal in the blank overflows between the punch and die and forms an attached fin surrounding the piece. It is the fin that must be trimmed to complete the work. The fin may not be entirely removed in trimming, but its outline may be trimmed to suit a flanged contour in the final design of the part.

Irregular edges around the tops of drawn shells are either pinched off at the time of drawing, or cut off in a subsequent trimming operation. For small shells the trimming is sometimes done in a hand fixture, and for larger shells in a trimming lathe; however, for quantity production a commercial die known as a Brehm Trimmer can be used.

When the open ends of drawn shells terminate in an annular rim or flange, the outer edge is also irregular until trimmed to size. If the drawn shell and rim are comparatively small, as produced in multiple-plunger eyelet machines, or in special progressive dies, the rim is trimmed in the final station, and the finished shell is then pushed through the die by the trimming punch.

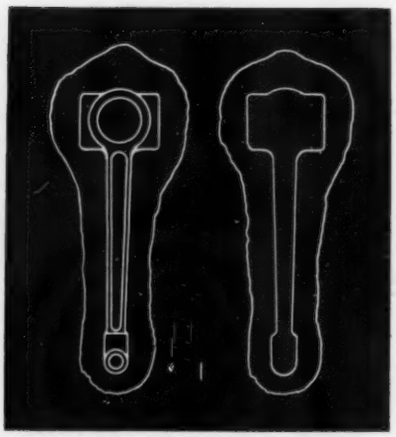


Fig. 71—Forged parts are placed in a trimming die for removal of the flash or fin, as at the left, this material representing the surplus material in the blank

In the progressive dies and eyelet machines mentioned, drawn shells with straight sides can be trimmed by pinching off the surplus ends. This process produces an edge slightly rounded and somewhat thinned, but the shell is usually satisfactory for ordinary uses. Figs. 72 and 73 illustrate the design of drawing dies used for pinching off the tops of shells.

Fig. 72 represents the conventional die used for drawing cylindrical shells in eyelet machines. It shows the final pinch-off station for sizing the shell diameter and trimming surplus metal from the top by pinching it off. The drawing punch *A* carries the shouldered cutting ring *B*, which can be adjusted to length after grinding. The height from underneath the ring to the end face of the drawing punch equals the finished depth of the shell. The cutting-ring diameter provides for only the thickness of the shell wall around the drawing punch. External diameters of the cutting ring and shell correspond with the internal diameter of the drawing die *C*.

When the punch descends, it draws the shell into the die to a position where the cutting ring closes the die opening. The cutting-ring edge is then forced through the interior side wall of the shell, and completes the cut depth as it enters the die. The punch, continuing in descent, delivers the shell through the die. Knockout-rod *D* strips the work from the punch when the die is used in an ordinary single-action press with a spring shedder pad under the shell.

Trimming Blanks

Fig. 73 shows a method for trimming off shell ends in a single-action combination blanking and drawing die. The stripper plate has been purposely omitted for clarity. Similar tool members have been lettered the same as those in Fig. 72, because the trimming action is the same in both.

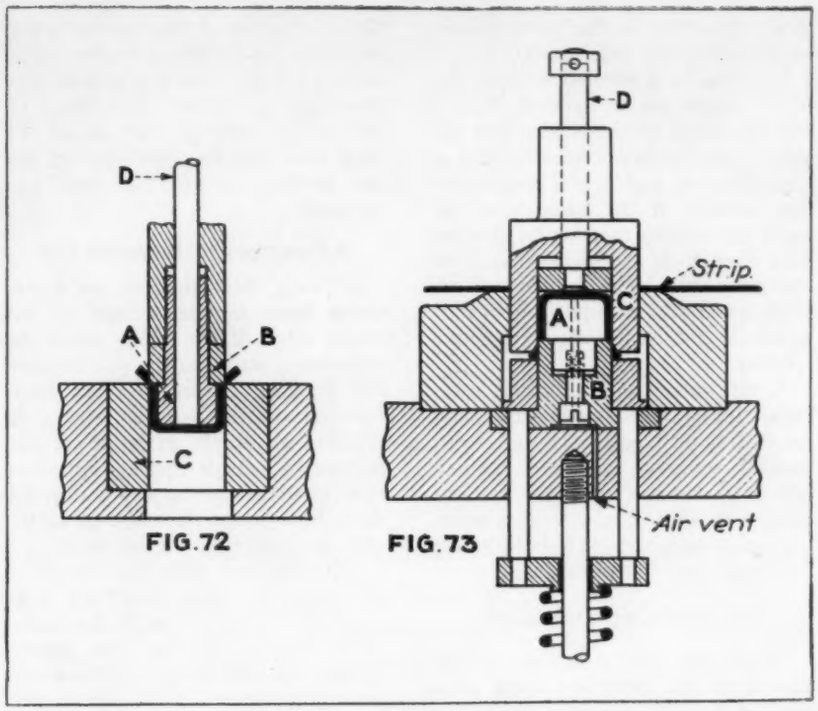


Fig. 72—A cutting ring B fits snugly into the die opening and is set at the correct height from the punch face, in order to "pinch off" the ragged edge of the drawn shell. Fig. 73—The principle illustrated in Fig. 72 applied to a compound die; however, an air inlet must be added so that a vacuum can not occur under the shell when being ejected

A hole is drilled through the punch, with an outlet in the die shoe, to admit air into the shell. This avoids creating a vacuum within the finished shell when it is being lifted from the punch and carried up within the die during the ram ascent and final ejection. Such construction is necessary because the success of a positive knockout depends entirely upon the certainty that the finished work will cling to the moving member of the die when it ascends.

Trimming Drawn Shells

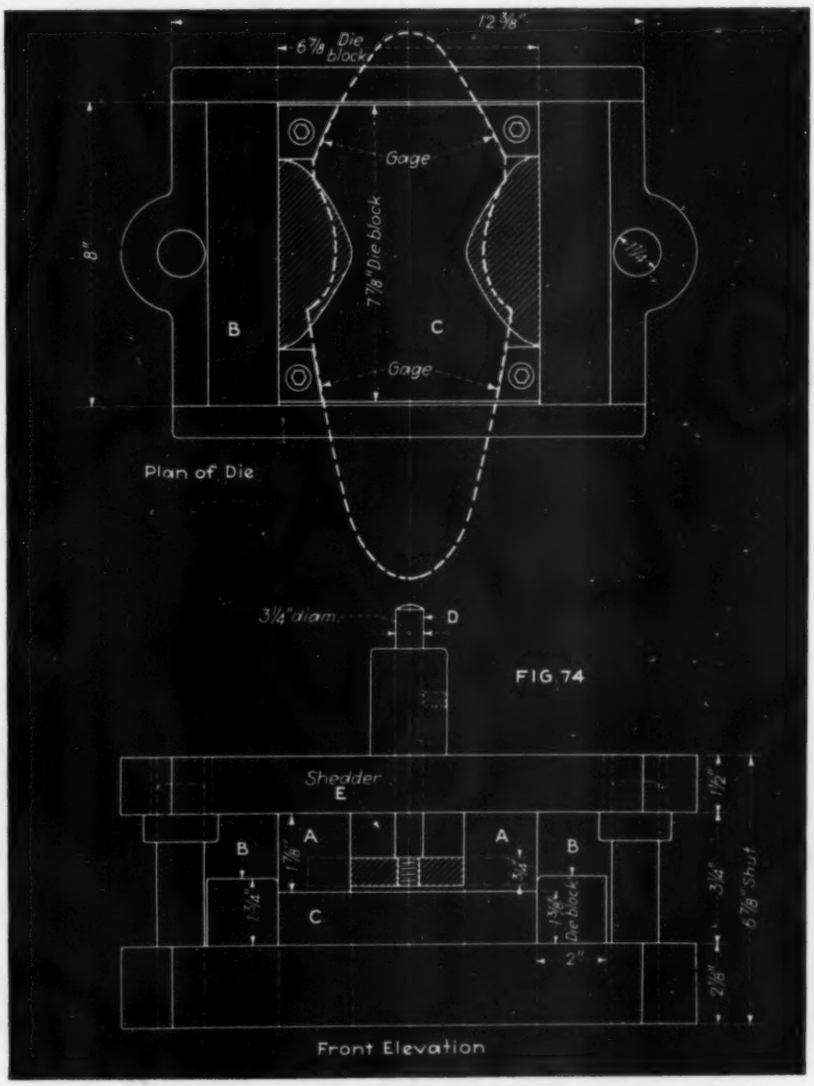
Whenever blanks can be trimmed to make other blanks, the time and expense of making another blanking die are saved. The idea is exemplified by Fig. 74. The blank outline, shown dotted over the die block, is in position to be trimmed when the punch descends. In this way two styles of blanks are made available for different shapes of drawn work. The larger blank is trimmed to make a smaller one.

In this case, instead of designing the trimming punches *A* with heels, which prevent nicked cutting edges (in a "bite in cut" through heavy sheet), the back-up heels are separate pieces fastened on the surface of the die openings before the cut begins. This leaves the faces of the trimming punches free of heel obstructions which may interfere with grinding.

After the down stroke the blank has been "cut in" between the two punches. It is then carried up, when the punch ascends, until the upper end of the positive knockout rod contacts a bar through the head of the press. This suddenly forces down shedder plate *E* attached to the rod, and behind the blank, thus ejecting the work from between the punches. The style of the die set used is the center-post type.

Generally speaking, positive knock-

Fig. 74—It is cheaper and quicker to build a trimming die for modifying a given blank to suit another shell, than to build an entirely new blanking die



outs, are used when the cut work clings so tightly in the dies, or around punches, that spring-pad stripping would be impractical. They are used in dies where a positively attached stripper plate would interfere in placing the work piece for an operation. When the blanks are $\frac{5}{64}$ in. thick, and up, a positive knockout is a more reliable work ejector than using springs. To eject heavy work with springs requires great compression, and heavy springs working against the ram descent is an unfavorable condition that should be avoided.

Selecting Strippers

Automotive body shops have adopted the following formula for stripping pressures determined from tension testing machines. This formula is also of value in determining stripping pressures in small dies. By using it, the strength and number of stripper springs can be ascertained, also the size and number of screws necessary for holding down positively attached stripper plates. In this formula P = pressure required for stripping in pounds, L = length of the cut edge of work in inches, and T = thickness of the material strip in inches; then

$$P = 3500 \times L \times T$$

A positive knockout is a great convenience if conditions favor its use. The work can be carried up with the ram ascent and then ejected clear of the dies. It is a quick and reliable method for automatically disposing of finished pieces. In using spring strippers there is always a chance of ejection failure, and the unobservant operator may continue feeding the tool which results in broken punches or dies, a fracture in the press frame, or distorting the crankshaft.

Selection of a suitable stripper depends largely on the type of the die and the shape of the work. For example, positive-knockout stripping is impractical in high-speed progressive dies because of the speed, and because the stations may not be situated near enough to the punch shank to operate a knockout rod through it. High-speed dies use light-gage metals which do not usually require positive ejectors.

A noteworthy tool design for trimming the ends of drawn shells, and for cutting-off lengths of tubing with smooth square edges and without burrs, is sketched in Fig. 75. The work is shown in Fig. 76. This shearing die is designed for handling only light-gage non-ferrous metals.

Balanced-Cut Trimming

While this tool is similar to one illustrated and described three years ago (*AM—Vol.* 80, page 336), this one is a decided improvement. The tool under discussion, operates on the "balanced-cut" principle, as shown by the double cutter blades *A*. When the ram descends, theses blades are advanced into the work by the descent of the hypothenuse in the right-angled triangle *B*. The hypothenuse is one side of a slot cut in the surface of cam plate *C*. The hypothenuse along this slot contacts the roller shown attached on slide *D* which carries the blades.

The work is held during the cutting interval by the two body and leaf blocks *E*. The leaves are opened to remove the trimmed shell and to place another shell for trimming, and are then locked with a cam not shown.

While it appears at first that the sharp points on the blades cut from outside the shell, this is not exacly true. The points on the blades first shear an oblique cut through the arc of the shell wall, and the remainder of the cut is from inside the shell and outward.

Advantages of Balanced Cut

In using this principle, no appreciable burrs can be formed on the inside edge of the shell, while the close-fitted blades in the slot between the holding blocks prevents burrs forming on the outside edges. In other words, this is an inside cut performed by outside cutters. An arbor is an unnecessary support within the shell, because the direction of all the cuts are away from the inside wall.

After the cam plate has descended to where the roller passes the acute angle in triangular slot *B*, the blades have finished the cut, and tension spring *F* immediately withdraws the holder and blades just before the vertical cutter *G* descends to finish the cuts previously made. The ram continuing in descent, forces the angular cutting blade *G* through the 0.040 in. slot which shears out the two small remaining necks *H*. In ascent, the roller on slide *D* follows through the vertical slot along the short side of triangle *B*. The roller is shown in its normal position in the sketch, with the ram up, and ready to trim the next shell. This idea is sometimes utilized in a bench-fixture design, in which compound hand levers operate the cutting blades.

Further types of trimming dies will be discussed in the next instalment of Mr. Hinman's series.

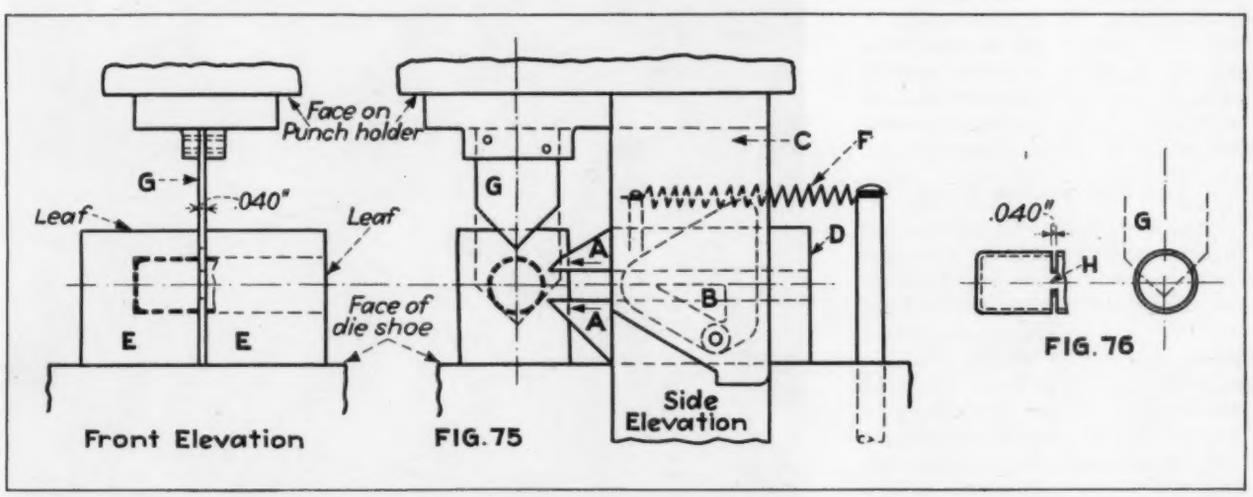


Fig. 75—Edges of drawn shells or tubing can be cut off squarely and without burrs by utilizing balanced cuts, and by using two sets of cutting members operated by cam action. Fig. 76—Necks H in the shells are left by the cutting members A in the die, Fig. 75, and are severed by the punch G

Give Debunking the Gate

DEBUNKING has long been a favorite American sport.

It has been indulged in extensively by biographers who thought it was "the thing" to tell the world about the shortcomings of George Washington, to reveal all the unpleasantries in Lincoln's life. Writers took delight in stripping national heroes of their virtues.

Debunking in recent years has reached over into business and industry. Hardly a day passed that an attempt was not made to show up some industrialist as a rotter. Government officials, union leaders and many assorted groups of people rushed to condemn the capitalist system, to lambast employers generally.

Now this debunking business has gone to work on democracy. This assignment is being carried out under the direction of two master debunkers—Der Fuehrer and Il Duce. Democracy stands revealed in all its incompetence, its ineptitude, its helplessness. Only dictatorships, they point out, are efficient.

You might think from all of this that the debunkers are sitting on top of the world. Well, if they are, they may, like Humpty-Dumpty, have a great fall. It doesn't take a Gallup poll to sense a current reaction against debunking.

Debunking biographers already are being overshadowed by the real historians who are seeking the truth rather than sensationalism. All of industry isn't rotten, and if one may judge by the election last November, the people don't think it is. Moderation has superseded the radical urge.

Democracy's debunkers, too, may not be so successful as they anticipate. People are beginning to rally around democracy's flag. Witness what the living stage is doing in presenting such stirring and patriotic dramas as "Abe Lincoln in Illinois" and "The American Way." Witness the fact that one of the chief aims of the New York World's Fair is to sell democracy to the people. Witness the quickness of the public in recognizing politics-playing in WPA, in rejecting the sitdown strike, in disapproving the President's tampering with the Supreme Court. So long as the American people choose the middle way, there isn't much danger that democracy will crumble.

Just one more word. The debunking spirit, now waning, may flare up again unless industry minds its P's and Q's. Social security is here to stay. Collective bargaining is here to stay. A franker and more friendly relationship between industry and its employees and between industry and the public is here to stay. And industry will help stabilize this new order of affairs if industry's leaders are as far-visioned as I believe they are.

Let's have our ideals and rally round them. Let's have our heroes and make the most of them. It is a wholesome attitude, and much needed now. And the heroes of industry will be those who strive earnestly to make democracy work in our economic structure as well as in our political structure.

Burnham Finney

GAGING BUSINESS

Substantial volume of machine tool orders reflects gradual expansion of operations in metal-working industry. Export and aircraft orders are prominent.

Operations in the metal-working industry appear to be slowly expanding. A substantial volume of machine tool business was placed in January, much of it being for export. Domestic inquiries are heavy, particularly from aircraft companies and from firms having government contracts. The steel rate is being maintained above 50 per cent with prospects bright for a rising output. Automotive sales have been good enough that car assemblies this month probably won't dip below the January total.

NEW ENGLAND—Machine tool sales, thanks to substantial foreign orders, were better in January than in December. Domestic business, too, is rising slowly. A flourishing number of inquiries for machinery is reported. The Springfield Armory has bought a considerable amount of new equipment. Pratt & Whitney Aircraft are believed close to the purchase of a big volume of machine tools for a French factory which will build its airplane engines. Winchester firearms is asking for bids on equipment.

NEW YORK—Foreign business continues to dominate the machine tool market. Japan has placed large orders, while pending French inquiries are sizable. It is understood that the Hispano-Suiza factory is to be retooled for production of airplanes. Many machinery people look for France to be their biggest export market this year. Germany is now in the American market for special machine tools which cannot be obtained elsewhere. Domestic machinery inquiries are growing. Wright Aeronautical is planning on some machinery buying. Eastman Kodak is reported to have out a large list of tools to be purchased soon.

PITTSBURGH—Steel operations are gradually rising, with the trade confident that February and March will bring further gains. Railroad tonnage has helped to keep the industry's rate at its current level which is better than 50 per cent. Automotive tonnage won't pick up much until around March 1. Important sales of heavy machine tools have been made by local dealers.

CINCINNATI—January was a fairly good month for machine tool builders who shared in substantial export orders. Dayton, Ohio, reports an increase in sales and inquiries following a lull early in January. Machinery inquiries at Indianapolis are good.

CLEVELAND — Machinery sales during January were moderately active. Auto parts factories continue to run about four days a week. The steel rate here, averaging 60 per cent, is above that of the industry.

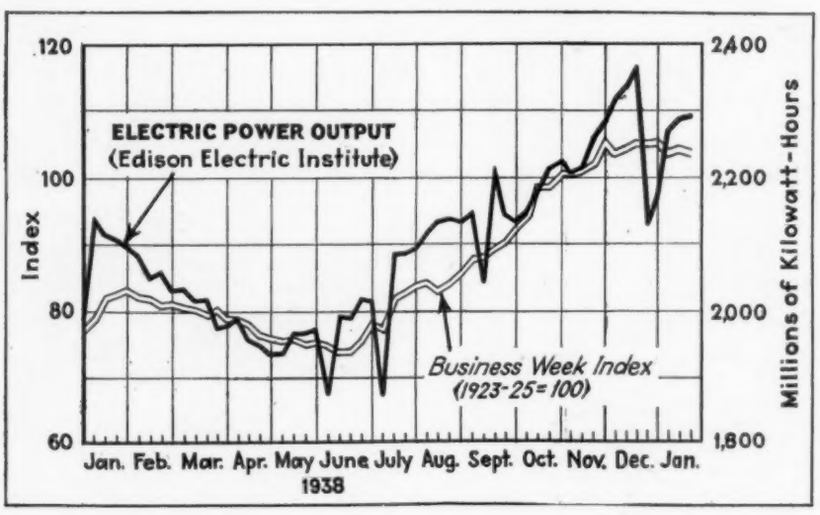
CHICAGO—Business is looking up somewhat. Railroad purchases of rails and rolling stock are giving steel production needed support. Electro-motive and Pullman will furnish engines and cars for Chicago & Northwestern's new streamliners. The Rock Island is to buy diesel streamliners to expand its Chicago-Denver service. The Wabash will order 10,000 tons of rails and will spend $37,000 on its shops. Sears Roebuck and Montgomery Ward are reported preparing low-priced tractors. The Sears tractor, reputedly to sell for $345, will have a Briggs & Stratton motor, will be assembled by Bradley. The Montgomery Ward unit will be priced at $369 and will be assembled by Simplicity Mfg. Co., Port Washington, Wis. Improvement is noted in agricultural implement plants in downstate Illinois. Milwaukee is more active. Some machinery dealers say that January business was better than any month of 1938.

DETROIT—Some motor car manufacturers expect to let out tool and die work for 1940 models within the next sixty days. Machine tool inquiries and sales are at low ebb. Even the small tool and supply trade is doing poorly. A few tool shops have received orders recently and will be busy for three or four months.

SAN FRANCISCO—Increased activities, a fairly hopeful outlook and orders coming from good sources are reported by western machine tool companies. Airplane makers in southern California are the most important purchasers. Plant additions planned by private and municipal electric systems during 1939 will cost $80,865,000, according to a survey by *Electrical West*. This is a 36 per cent increase over 1938.

POWER OUTPUT VS. GENERAL BUSINESS

With many industrial indexes showing appreciable contra-seasonal rises, electric power consumption has regained most of the ground lost during the year-end holidays



NEWS OF THE INDUSTRY

U.A.W. Split Raises Complications Regarding Arbitration of Automotive Labor Disputes

G.M. typical in sitting tight until union officers' "position and authority have been clarified"

FRANK RISING
Labor Editor, American Machinist

DETROIT—Two unions grew where where but one grew before, in Detroit this week. Rank and file members of the United Automobile Workers were lining up behind Homer Martin, or behind Martin's former executive board—which had not only repudiated his leadership but had filed charges of "unfair labor practices" against him with the NLRB.

Most observers feel that Martin—now cut off completely by C.I.O., which has given its approval to the executive board—will build himself a union of his own. He has called a convention for March 4 in Detroit, and undoubtedly will be chosen president by those who attend that meeting.

Impartial estimators give the executive board and its pro-tem president, R. J. Thomas, the majority of present U.A.W. membership. Having called a convention for March 27 in Cleveland, this group will return all the anti-Martin executives to high offices, will publicly name Sidney Hillman and Philip Murray of C.I.O. as its advisers, and will announce a program of stern discipline for any violation of contractural relations with employers. It is on this last point that the board relies to convince Detroit management of its sense of responsibility.

Martin supporters figure that all he has to do is to rebuild his part of the U.A.W. with himself at the wheel, and the closely guarded doors of the Ford Motor Co. will be open to him. In fact, Harry Bennett of Ford has already admitted that he told Martin last fall to "organize the boys if he could."

Officially, management hasn't been taking sides. In fact, General Motors spoke the mind of the industry last week when it announced that it would deal with shop committeemen for the present and wait for proof of international officer's authority, before proceeding with new contract talks.

WILL MAKE GIANT ENGINES

INDIANAPOLIS — The Allison Engineering division of General Motors Corp., is reported preparing to spend large sums on new equipment needed for much larger production of airplane engines, presumably for installation in planes to be supplied to the United States air forces.

Allison is known to be considering construction of a sizable new factory here. It is believed that pending plans are in connection with development of a new, larger and more powerful airplane engine. It is no secret that government aviation experts hold the Allison-design engine in high esteem.

NEW TOOL & DIE, PRESS SHOPS PUT INTO PRODUCTION BY FORD

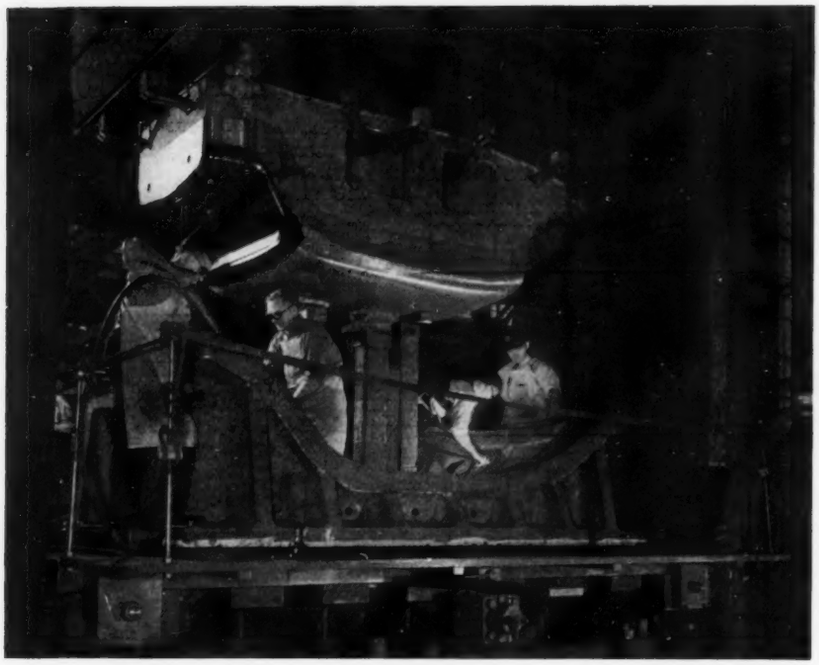
DETROIT—Two of the major units in the $34,000,000 plant expansion program carried out during 1938 by the Ford Motor Co. were virtually completed early in January of this year, it was revealed recently.

These two units are the press shop and the tool and die shop, each one of which has several features unique in industry. Both are designed to advance the straight-line production methods which the Ford organization has pioneered.

Press Shop Connects with Mill

The press shop has 1,500,000 sq.ft. of floor space, with 850,000 sq.ft. on the main manufacturing floor and the remainder in the above-ground basement floor. The building, an L-shaped structure, forms a part of a united building which covers 64 acres and is three-fourths of a mile long and 1,000 ft. wide. The new building joins the old press steel building, the spring and

The Press of Business—*These fender draw presses are installed in the new Ford press shop, which was put into operation to increase the company's capacity for making finished body sub-assemblies. Shop contains 300 new presses out of a total of 2,100*



Air Conditioned—*Men putting the finishing touches on this roof panel die work in the air-conditioned comfort of the new tool and die shop just put into operation by Ford. Said to be the largest structure in the world designed solely for this purpose, the building is 1,225 ft. long and 300 ft. wide. There are 1,311 machines in the shop, of which 508 are new*

upset building and the rolling mill, and that building in turn is connected with the open hearth. The main part of the new building itself is 1,660x392 ft., while the L is 664x240 ft.

There are 2,100 presses in the new shop, 300 of them being new. Along with the other equipment in the new shop, they have increased the plant's capacity by 2,000 bodies per day.

The new air-conditioned tool and die shop concentrates almost all the Rouge plant tool and die work under one roof. The structure is probably the largest building in the world designed solely for tool and die work, measuring 1,225x300 ft. There are 1,311 machines in the shop, 508 of them new.

Conspicuous features of the shop are the uncluttered interior arrangement and the excellent lighting. Columns have been held to a minimum. Monitors and walls are largely of glass, and the building itself is set well away from other structures so that sunlight is unobstructed. Overhead steel work, air-conditioning ducts, roof and side walls are painted white to improve the illumination.

NOTIFIED OF EXAMINATION

WASHINGTON—Notices have been sent out concerning application to take Civil Service examinations dealing with field representative positions in the apprenticeship service, Division of Labor Standards, Department of Labor. Applications must be on file with the United States Civil Service Commission not later than Feb. 14.

1938 MACHINE TOOL EXPORTS ESTABLISH NEW HIGH RECORD

WASHINGTON—Exports of power-driven metal-working machinery reached an all-time high in 1938 and advanced 62 per cent above the 1937 level, according to figures compiled by the machinery division, Bureau of Foreign and Domestic Commerce.

Practically all items in the machine tool group shared in the advance, which put the year's exports at the record level of $97,270,616. Outstanding among the gains were engine lathes, milling machines, grinding machines, and sheet and plate metal working machines, all of which showed approximately a 100 per cent increase over 1937. Also registering prominent gains were exports of rolling mill machinery and parts, turret lathes, boring mills, automatic screw machines, gear cutting machines and drilling machines.

Foreign sales of the machine tool classification contributed importantly to the increase in total industrial machinery export values, which amounted to $269,856,041. This represents a 12 per cent gain over the previous year, and places the value of industrial machinery exports within 3 per cent of the record established in 1929.

Exports of Machinery During December, 1938

	December 1938	November 1938	December 1937
Electrical machinery	$9,876,700	$7,947,853	$9,797,476
Power generating machinery except automotive and electric	1,278,872	1,089,348	1,565,450
Construction and conveying machinery	2,218,115	1,396,215	2,066,984
Mining, well and pumping Machinery	4,991,166	4,074,140	5,203,635
Power driven, metal-working machinery	9,873,371	8,044,476	7,720,824
Other metal-working machinery	330,815	301,162	359,361
Textile machinery	663,598	653,129	1,135,687

Exports of Metal-Working Machinery During December, 1938

Engine lathes	383,696	676,641	487,644
Turret lathes	348,816	472,778	582,278
Other lathes	171,999	114,946	233,234
Vertical boring mills and chucking machines	335,598	230,236	172,316
Thread cutting and automatic screw machines	473,073	434,311	564,318
Knee and column type milling machines	269,346	78,754	482,717
Other milling machines	1,411,354	1,295,353	339,069
Gear-cutting machines	269,832	212,181	312,651
Vertical drilling machines	95,717	15,467	63,265
Radial drilling machines	51,389	60,502	176,639
Other drilling machines	151,431	87,702	255,480
Planers and shapers	541,825	194,432	134,325
Surface grinding machines	436,454	160,724	229,995
External cylindrical grinding machines	287,885	171,667	393,686
Internal grinding machines	267,357	236,955	292,197
Tool grinding, cutter grinding, and universal grinding machines	320,432	202,360	226,488
Other metal-grinding machines and parts	396,650	365,398	154,251
Sheet and plate metal-working machines and parts	775,534	932,404	329,537
Forging machinery and parts	556,923	197,776	243,016
Rolling mill machinery and parts	1,472,350	795,146	1,269,063
Foundry and molding equipment and parts	47,256	110,670	161,859
Other power-driven metal-working machinery and parts	808,454	1,002,073	616,796

Other Metal-Working Machinery

Pneumatic portable tools	100,807	90,944	79,289
Portable and hand and foot operated metal-working machines and parts	101,582	83,766	122,083
Milling cutters, machinery operated thread dies and taps and similar machinery operated metal cutting tools	59,697	67,338	58,334
Other metal-working machine tools	36,263	33,632	79,590
Chucks for machine tools	32,466	25,482	20,065

INSIDE DETROIT

Rupert Le Grand
DETROIT EDITOR

Things are looking up for automotive tool and die suppliers, with extensive styling changes expected for 1940. Much press shop modernization is already under way

DETROIT—If normal cycles mean anything, the automotive industry will make extensive body changes in 1940 models. Tool and die circles say that they are hopeful of some real work this spring because: (1) 1940 will be the second year of the usual two-year cycle in body styles, (2) that while 1939 models offer interesting refinements of earlier trends it will soon be time to start with something fresh, and (3) if these changes are accepted by management, considerable die work should be placed in this city. The labor trouble prevalent a year ago has disappeared, and it is expected that Detroit shops will again get a good share of the business despite higher labor costs.

Extensive body and fender changes will not of themselves bring much additional business to press builders. It is known that many of the large presses in use today are inadequate in rigidity, capacity and speed. But most of the large press users would like to see some kind of development in automatic feeding, which has not been done yet with fender or panel presses. And others are privately concerned about spending huge sums of money without a genuine prospect of good business for two or three years. Some of them are fearful of going ahead because they envision a dip at the outset of 1940 to last through the year.

Press Shop Expansions

Extensive additions in press shop capacity have recently been made by several companies. De Soto has a new plant wherein most of the Chrysler stampings are produced. Fisher Body at Grand Rapids is fitted out with a modern shop and is said to be making extensive additions. Ford has spent several millions on new presses for its pressed steel building, although it is understood that the original program was cut down about 50 per cent. Even so, an order recently was issued for a huge triple-action press. No doubt more equipment will be added. Briggs, which had a $1,000,000 program under way last year after the Ford business was pulled in, is still considered a good prospect because it will probably integrate its facilities more and more with Chrysler.

Production for February is now likely to hold up on a level with January, and the expected dip will prove unnecessary while sales hold as good as they are. January production was in the neighborhood of 360,000 cars and trucks.

PLAN 1,000-HP. ENGINES

Continental Motors, which until now has not built aircraft motors larger than 250 hp., is now contemplating engines of 1,000 hp. It is understood that an R.F.C. loan has been obtained. Efforts are said to have been made to secure outside toolroom facilities, without avail, and inquiries have been sent out for a score or more machines, principally used, with which to tool up for the new venture.

In the four years from 1935-1938 inclusive, March production has ranged from 55 to 73 per cent of the combined totals of the preceding two months. If an average of 65 per cent is struck and applied to prospects for March, 1939, the figure arrived at is 65 per cent of 720,000, or 468,000 units. Thus, the projected production for the first quarter is approximately 1,200,000 cars and trucks. This figure tops production in the first quarter of 1937 by 142,000 units and the first quarter of 1938, when abnormal conditions prevailed, by 532,000 units. As 1939 moves on it seems likely that a 4,000,000-car year will be reached.

Light Car by Studebaker

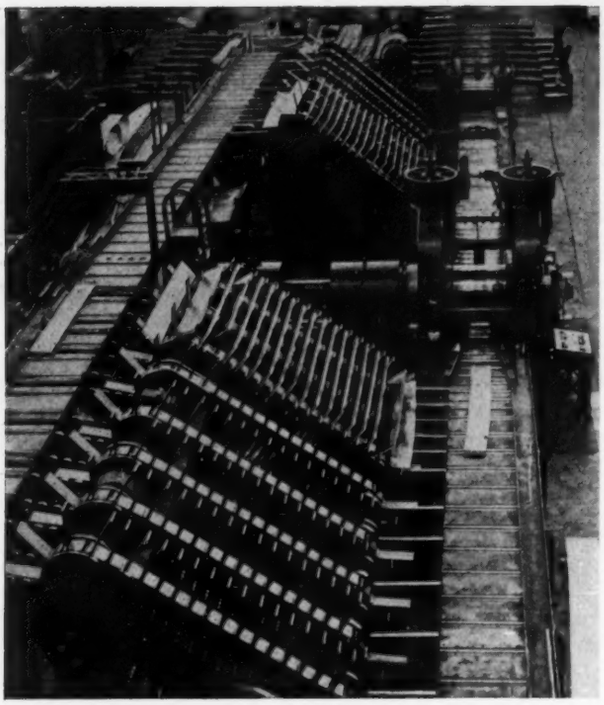
Studebaker's entry into the light-car field has a 112-in. wheel-base, it is reported. Those who have ridden in the car say that it has a snappy motor and exceptional riding qualities. Considerable equipment was bought last summer and fall, which would indicate that much engineering work was done on a light car to compete with the Big Three.

Local suppliers hope to share in the International Harvester $8,000,000 modernization programs at Rock Island and Milwaukee. Approximately $75,000 will be spent for gear cutting machinery in both plants. Greatest emphasis in the new program is on production facilities for the new Farmall tractor.

Safety Hits New High

General Motors reports an all time safety record for its 86 plants in United States and Canada. For every 125,000 eight-hour day of operation last year, there were only 4.91

Weld Done—*Oldsmobile's recent adoption of "Quadri-Coil" spring suspension has necessitated several new welding operations in building rear axle housings. One of these, shown above, consists of spot welding to the housing a pair of rubber-cushioned bases for the attachment of stabilizing arms. A subsequent weld fixes in place the bracket for the "track bar" or lateral stabilizer*



"Escalators"

Conveyor system in the breakdown mill in the new Revere brass mill at Rome, N. Y. includes two "escalator" conveyors. As each slab emerges from the rolls, an "electric eye" causes it to be pushed onto the first escalator which delivers it to the upper level conveyor. This carries the slab to the second escalator, on which it descends to the horizontal conveyor at the front of the mill, ready for a second trip between the rolls

UNUSUAL MATERIALS HANDLING FEATURES REVERE BRASS MILL

NEW YORK—Revere Copper & Brass, Inc., has completed a $3,250,000 brass and copper mill at Rome, N. Y., as part of an extensive modernization program inaugurated several years ago, according to C. Donald Dallas, president.

Incorporating the latest innovations in straight-line production in the copper and brass industry, the new mill has a monthly capacity of 2,000,000 lb. of brass strip up to 20 in. in width. Adoption of the materials handling system which is said to constitute a radical departure in the copper and brass industry has resulted in a compactness which allows this capacity to be contained within a floor area of 72,000 sq.ft., which is believed to be the lowest ratio in the industry.

Outstanding innovations include a new "escalator" conveyor system whereby the brass slabs are automatically fed and refed into the breakdown mills, each sequence being controlled by a series of "electric eyes."

lost-time accidents, compared to 5.15 lost-time accidents in 1937 and 5.19 in 1936. Severity of accidents was reduced 0.595 days per every 1000 hours of work. The Packard Electric plant and the Sunlight Electric plant at Warren, Ohio, had their second year without a lost-time accident. Pontiac and A.C. Spark Plug established new all-time safety records in their plants.

JAPAN ACTIVE IN MACHINE TOOL MARKET; CHINESE ORDERS SEEN

NEW YORK—The Japanese have been exceptionally active buyers of machine tools during December and January. The equipment is destined for use in Japanese government factories turning out war material.

The Chinese government had planned for some time to consolidate its aircraft and airplane parts manufacture at one factory in the interior of China. For such a factory it was the intention to buy a considerable amount of new equipment, some of it in the United States, and to install some old equipment removed from Chinese plants abandoned to the Japanese. It is not known whether it is still possible to carry out that plan, now that the Chinese have been compelled to retreat so far into the interior.

Jacobson Heads Chrysler Sales

Charles L. Jacobson, former sales manager Chrysler Div., Chrysler Corp., has been appointed vice-president and general sales manager to succeed Joseph W. Frazer, resigned.

U. S. Government Contracts Awarded to Metal-Working Firms

(Awarded from Jan. 9–21 inclusive)

Contractor	Gov't Agency	Commodity	Amount
Midvale Co., Washington, D. C.	Navy, S. & A.	Slides	$486,500
Bethlehem Steel Co., Bethlehem, Pa.	Navy, S. & A.	Castings, slides	21,600
Ohio Seamless Tube Co., Shelby, Ohio	War, Air Corps	Tubing	53,084
Steel & Tubes, Inc., Cleveland, Ohio	Navy, S. & A.	Pipe, extractors	111,174
Sheffield Steel Corp., Kansas City, Mo.	War, Engineers	Galvanized wire	29,329
American Chain & Cable Co., Hazard Wire Rope Div., Wilkes-Barre, Pa.	Philadelphia Navy Yard	Cable	33,144
Wire Rope Corp. of America, New Haven, Conn.	Navy, S. & A.	Wire rope	23,778
E. H. Edwards Co., San Francisco, Calif.	Navy, S. & A.	Wire rope	27,180
John Wood Mfg. Co., Conshohocken, Pa.	Navy, S. & A.	Steel boxes	285,310
Pressed Steel Tank Co., West Allis, Wis.	Navy, S. & A.	Blank shells	27,803
Jones & Lamson Machine Co., Springfield, Vt.	Navy, S. & A.	Grinder	16,143
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	Navy, S. & A.	Milling machine	18,067
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy, S. & A.	Lathes	40,670
The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio	Navy, S. & A.	Lathe	10,389
Cincinnati Shaper Co., Cincinnati, Ohio	Navy, S. & A.	Shears	14,213
Worthington Pump & Machinery Corp., Harrison, N. J.	Interior	Pumps	35,900
Northern Pump Co., Minneapolis, Minn.	Navy, S. & A.	Pumps	30,800
Continental Electric Co., Newark, N. J.	Navy, S. & A.	Motor-generators	35,549
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	T. V. A.	Transformer	25,026
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	T. V. A.	Power transformer	44,700
United Aircraft Corp., Pratt & Whitney Aircraft Div., E. Hartford, Conn.	Philadelphia Navy Yard	Engine parts and tools	40,782
Magor Car Corp., New York, N. Y.	Navy, S. & A.	Railroad flat cars	68,961
Truscon Steel C., New York, N. Y.	W. P. A., Treas., Proc.	Steel sash	22,927
Bethlehem Steel Co., Los Angeles, Calif.	W. P. A., Treas., Proc.	Reinforcing steel	56,824
Koppers Co., Bartlett-Hayward Div., Baltimore, Md.	Interior	Gates & units	89,000
Lukenweld, Inc., Coatesville, Pa.	War, Ordnance	Base ring weldments	37,065
Ilg Electric Ventilating Co., Chicago, Ill.	Navy, S. & A.	Fans	36,967
Chas. F. Elmes Engineering Works, Chicago, Ill.	War, Ordnance	Accumulator	27,300
Ex-Cell-O Corp., Detroit, Mich.	Navy, S. & A.	Engine parts	144,038
Skinner Engine Co., Erie, Pa.	War, Engineers	Steam engine	66,485
General Machinery Corp., Niles Tool Works Div., Hamilton, Ohio	Navy, S. & A.	Planer	143,225
Wm. Sellers & Co., Philadelphia, Pa.	Navy, S. & A.	Planers	279,100
Hydraulic Press Mfg. Co., Mount Gilead, Ohio	Navy, S. & A.	Presses	74,000
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	Navy, S. & A.	Milling machines	55,004
Bullard Co., Bridgeport, Conn.	War, Ordnance	Chucking machine	35,585
H. R. Krueger & Co., Detroit, Mich.	War, Ordnance	Drilling machine	32,330
Electric Arc Cutting & Welding Co., Newark, N. J.	War, Ordnance	Generating units	129,270
Robbins & Myers, Inc., Springfield, Ohio	Treas., Proc.	Fans	267,325

A continuous conveying system carries the slabs through an annealing furnace and back to the rolling mill or to the scalping machine, thus eliminating the usual method of loading and unloading pans.

Unique in the industry is Revere's new method of handling coiled brass strips almost exclusively by roller conveyors. This conveyor system has been made unusually flexible by an elaborate switching and storing arrangement, which permits the use of many combinations of processes on a straight-line production basis.

$100,000 STUDY OF WELDING BEGUN BY ENGINEERING BODY

NEW YORK—A $100,000 program of welding research will be carried out by the welding research committee of the Engineering Foundation in cooperation with the leading scientific talent in the field, it was announced recently by William Spraragen, technical secretary.

The importance of the study is reflected in the new shipbuilding and armament program which will involve extensive applications of welding in ship construction, pipe lines, aircraft, tanks and other machines of war, Mr. Spraragen pointed out. "Structures like ships, buildings and bridges must be designed carefully and with absolute safety. The test data for determining design values in the various building codes are being secured by groups working under the welding research committee.

"The new alloy steels which are so prominent in all phases of transportation because of their light weight and high strength, present difficult problems to the welding engineers," he continued. The findings of investigations now being conducted in various universities throughout the nation have played an important part in influencing the steel-maker to so proportion the alloys in steels that they may be readily weldable, Mr. Spraragen pointed out.

TO TEST MUNITIONS MACHINERY

TOKYO—A government experiment station to test new machine tools for the nation's munitions and commercial industries will be opened near Tokyo during the next fiscal year, according to a report to the United States Department of Commerce from the office of the American Commercial Attache in Japan.

The commission on the machine tool manufacturing industry points out that the number of Japanese shops engaged in the manufacture of heavy industry equipment has increased to more than 200 under the impetus of prevailing conditions and that it is necessary for rigid inspection to be made of the products.

Nightmare—*This fantastic maze of conveyors is installed in Revere Copper & Brass' new brass mill at Rome, N. Y. Unique switching arrangements provide unusual flexibility, while spiral storage conveyors help provide a continuous supply of material for numerous straight-line operations*

TO BUY MACHINE TOOLS

TORONTO—The Canadian government is to purchase $500,000 to $750,000 of machine tools to be used by the John Inglis Co. in making the Bren machine guns and rifles for Canada and for Great Britain. Bids on this business, much of which will be placed in the United States, are to have closed Feb. 7. It is expected that other important tooling programs will appear in Canada later in the year as armament manufacturing plans develop.

QUALITY FINISH HELPS EXPORT TOOL SALES, REPORT INDICATES

WASHINGTON—The finish provided American-made tools is a strong selling point in the markets of Great Britain and purchasers prefer such tools even though they are slightly more costly than competitive products which are not as well finished, according to a report from the American Consulate, Sheffield, made public by the Department of Commerce.

However, it behooves American manufacturers to strive constantly to improve their product for this market, the report states, since British manufacturers are constantly improving their product and gradually changing them until many types of British-made tools are now similar in appearance to those of United States origin.

SURFACE FINISHING METHODS WILL HIGHLIGHT A.S.T.E. MEET

DETROIT—A symposium on "Surface Finish," with proponents of all methods of accurate surface finishing presenting papers on grinding, lapping, diamond boring, honing, and "super-finishing," will highlight the 1939 American Society of Tool Engineers convention to be held in Detroit March 14–18.

There will be no daytime technical sessions, leaving delegates free to visit the Machine & Tool Progress Exhibition as well as the numerous industrial plants in Detroit in which special plant tours have been arranged for convention week.

A second symposium, entitled "New Developments and their effect on the Tool Engineer," will bring together in one evening session an important group of papers on new methods, materials, equipment, etc., of prime interest to tool engineers.

This year another important departure will take place. Monday evening, March 13, there will be a special "preview" dinner to which leading industrialists, educators, editors, ministers and legislators, are invited. At this dinner, sponsored by a committee of industrialists, headed by K. T. Keller, president Chrysler Corp., the "Fact Finding Committee" of the A.S.T.E. under Professor John M. Younger, Ohio State University, will present its first report—on "The Relationship of the Machine to Employment and Standard of Living."

WATCHING WASHINGTON

McGraw-Hill Washington Bureau
PAUL WOOTON, CHIEF

Walsh and Healey propose six amendments to the original Walsh-Healey Act. Selling planes to France is considered justified by majority of observers

WASHINGTON—Six amendments to the Walsh-Healey Act have been proposed by Sen. David I. Walsh and Rep. Arthur D. Healey. The amendments would impose upon all government contractors the Navy 10% profit limitation; lower the $10.000 minimum to $2.000; bring under the act some non-professional services, such as laundries; permit board and lodging deductions; lower the minimum age to 16 where jobs are not hazardous; and permit recovery of wages by employees in case of violation—double for second offense, triple for the third. There will be no "black list" of non-compliers this time. It will be recalled that similar amendments were rejected last year, seemingly as a result of John Lewis' overzealous invasion of Capitol Hill in their behalf.

Common Sense in Selling France Planes

Neutrality-minded congressmen who tackled the President for cavalier interpretation of the munitions control law in selling a big order of airplanes to France, were headed for defeat when they started. The law says that critical military developments may not be sold abroad till they have been in use in the U.S. a year or more. But no one familiar with the Executive's power in foreign relations really believes for a minute that England and France, with whom this country is in love just now, cannot get all the airplanes we can furnish, old or new. The President's argument that we need the orders to build up our own production is unanswerable. And to send airplane customers away would be to hasten the day when other countries will cut into American airplane export business. In fact, Canada for one would like to build airplanes and some American manufacturers would expand the plants now there.

Agree on Need for Patent Protection

Science and American business still need the protection of the patent system. Nearly everybody seemed in agreement on that point as the National Economic Committee ended its second series of hearings Jan. 20. Testimony indicated that no major change is necessary but that legal restrictions on individual inventors should be removed; that lawyers' shenanegans extending the protection period indefinitely should be stopped; that a single patent court would be helpful in eliminating long delays in litigation; that patent office procedure should be speeded up. Action along these lines is expected by this session of Congress.

To Hear A.F.L. Suggestions

Hearings on American Federation of Labor's nine amendments to the Labor Relations Act will begin within a month or so. Washington opinion seems to be weighted in favor of enactment in some form, on the ground the changes appeal to common sense and fairness to management and to competitive unions. The opposition to change will argue that the board, not the act, is responsible for ill will created; that when D. W. Smith is out and a more acceptable member is in, the situation will improve, and that the courts should have opportunity to express further judgment. A bill identical to that sent to the Senate is being offered to the House.

International News Photo

Secretary of the Treasury Henry Morgenthau (left) chats with Senator Morris Sheppard, chairman of the Senate Military Affairs Committee, at the hearing Jan. 27 when the committee investigated circumstances surrounding the presence of a representative of the French Air Ministry in a light bomber of the U. S. Army which crashed, injuring him and the pilot, during a test flight at Los Angeles. The plane is said to have embodied certain secret technical devices which the War Department wanted safeguarded. According to Air Corp officials, Paul Chemidlin, the French official, was taken for a demonstration flight at the express request of the Treasury Department over the protests of Army men

Educational Orders Bids Received

Bids on four of the educational orders items, submitted to selected manufacturers in circular proposals by the War Department, have been received and the returns on the other two were expected as this is written. Officers in charge say again this fortnight that they will be engaged for an indefinite time on the complicated job of evaluating the alternative conditions set up by the bidders, and their relative qualifications to "serve the public interest."

Wage-Hour Law Seen as Success

Washington generally feels that the Wage-Hour law is quite a success, so far. Violations appear to be few. Administrator Andrews, after weeks of sleuthing, has found one textile firm that is willing to stand on its convictions and challenge the law in court. But the decision will have no particular constitutional significance. The Division staff is now about 200 all told, and more investigators are being sent into the field. The first "industrial committee" wage determination (for textiles) will come about May 1, or later. Perhaps twelve or fifteen committees will be in action before the summer is over, but metalworking is not on the list. Andrews is not pressing amendments, due to brief experience; he may even pass up the problem of hours coverage of high-wage people.

May Change Social Security

The Social Security board and its advisory council have recommended to Congress important changes in the act. Whether or not the President is in complete sympathy with these extensions, the Administration is forced to accept them by groups of "ham and eggers" who already have powerful lobbies at work on the Hill. Eventual coverage of all employed and self-employed persons now seems inevitable. Undoubtedly some, maybe all, of the recommendations will be enacted by Congress. The proposal to begin monthly benefits next year instead of 1942 is most vital. Others: to provide benefits for aged dependent wives; to calculate benefits on average wages instead of on accumulated wages; to extend benefits to farm, domestic, maritime, non-profit, Federal, national bank and other employees, and children.

WILLIAM L. BATT

LABOR RELATIONS ACT BIASED, HOOK CHARGES IN BROADCAST

WASHINGTON—The National Labor Relations Act was criticized as being biased in favor of organized labor by Charles R. Hook, president American Rolling Mill Co., and chairman of the National Association of Manufacturers, in a broadcast of the American Forum of the Air Jan. 29. Mr. Hook's accusations were countered by J. Warren Madden, N.L.R.B. chairman, who pointed out several benefits under the law.

Mr. Hook scored the act on five principal points:

"The mutuality of interest of employer and employee should be recognized.

"The function of government should be that of assuring that employees shall not be subject to coercion from any source, as declared by President Roosevelt in settling the automobile strike in March, 1934.

"The emphasis on strikes should be modified. In the act as it now stands too much emphasis is on the right to strike. There is no emphasis at all on when it is wrong to strike.

"There should be recognition that every man has the right to work unmolested, whether or not he is a member of a labor organiaztion.

"The dominant philosophy guiding the act should be absolute protection of the paramount public interest."

Mr. Hook asserted that "the obvious thing to do is to amend the Wagner Act so as to correct its one-sided character; to separate the functions of fact-finding, prosecution and judicial decision; and to do everything that Congress can do to guarantee impartial administration."

Mr. Madden, in replying to some of Mr. Hook's charges, pointed out that "the act provides for no penalties, no fines, no jail sentences, except for intentional interference with an agent of the board in the performance of his official duties. Employers can be proceeded against only in the most considerate and deliberate fashion, with full opportunity to present their side of the case in open hearing. . . ."

MANAGEMENT'S PART IN PEACE STRESSED AT COUNCIL DINNER

NEW YORK — International peace rests strongly on sound industrial management, according to speakers at the annual dinner of the National Management Council, held at the Hotel Biltmore, Feb. 1. Members and guests of the seven societies, which cooperate in the work of the Council, were addressed by Erwin H. Schell, professor of engineering and business administration, Massachusetts Institute of Technology, and William L. Batt, president, S.K.F. Industries, Inc. Howard Coonley, president National Association of Manufacturers, and president Walworth Co., presided at the dinner.

Professor Schell described the management congresses in London and in Washington, giving his impressions of the international interest displayed at these sessions. He noted that attendance at the meeting in England by members of Parliament and the House of Lords was indicative of the interest of government in sound business management. He pointed out that international peace depended on a satisfied citizenry and that a satisfied citizenry depended largely on intelligent industrial management.

Mr. Batt spoke of the four groups to which management has a direct responsibility: its customers, its employees, the public at large, and its stockholders. He emphasized that whereas in previous years the stockholders came first, today they and management realize that their interests are not served unless their obligations to the other groups receive first consideration.

DEFENSE FUNDS CERTAIN

WASHINGTON — Nothing can stop the approval by congress of the President's armament program, not even the tremendous minority sentiment against it, which is just now showing up on the Hill as resentment against F.D.R.'s secret handling of foreign relations, a practice that all Presidents have followed. Some observers, staggered by the mounting cost of defense ($1,335,000,000 in 1939—four times that of 1916) want to know why. The main reason is the more intricate and expensive machinery used in modern war. Of the $300,000,000 asked for to buy airplanes, $50,000,000 is expected soon.

MARITIME COMMISSION ORDERS TEN PASSENGER-CARGO SHIPS

WASHINGTON — Contracts for the construction of ten combination passenger-cargo ships of the C-3 type were awarded recently by the Maritime Commission.

The Newport News Shipbuilding & Drydock Co., Newport News, Va., was awarded the contract for six of the ships, which will cost $2,890,000 each. These vessels, which will be steam-propelled, are for use in the San Francisco round-the-world service.

Sun Shipbuilding & Drydock Co., Chester, Pa., contracted for the construction of the remaining vessels at $3,167,100 each. To be powered by diesel engines, these four ships are for the Seattle-Orient route.

Herringbones

Train of sixteen double helical gears ready for inspection at the Lewis Foundry & Machine Division, Blaw-Knox Co., Pittsburgh. Ranging from 28 to 101 in. in diameter, and weighing about 200 tons, the gears will form the drive of an eight-stand continuous mill

C. B. BOHN

J. W. FRAZER

W. H. WINTERROWD

PERSONALS

CHARLES B. BOHN, Bohn Aluminum & Brass Corp., Detroit, has been elected president of the Aluminum Association. He succeeds ARTHUR V. DAVIS, Aluminum Co. of America, who was elected chairman of the board of the association.

Also elected were W. G. GOLDEN, Reynolds Metal Corp., Eastern division vice-president; H. B. HARVEY, Harvey Metal Corp., Western division vice-president; J. J. GERAGHTY, Johnston Tin Foil & Metal Co., Southwestern division vice-president.

JOSEPH W. FRAZER, former vice-president in charge of sales, Chrysler Div., Chrysler Corp., has been elected president of Willys-Overland Motors, Inc., Toledo, Ohio. He succeeds DAVID R. WILSON, who will remain as a director.

Mr. Frazer started in the automotive industry 26 years ago as a shop man, later managed a large time-payment financing organization, and held sales posts with General Motors before joining Walter P. Chrysler in 1924. He was appointed sales manager of Chrysler Corp. in 1927.

Other officers elected by the Willys-Overland directors include DELMAR G. ROOS, vice-president in charge of engineering; JOHN SHOTWELL, treasurer; GEORGE RITTER, secretary and counsel. Resignation of W. C. COWLING, vice-president in charge of sales, was accepted.

D. S. BRISBIN, Columbus-McKinnon Chain Corp., was elected president of the Motor and Equipment Manufacturers Association at a meeting of the board of directors Jan. 10. Other officers chosen include D. H. DASKAL, Perfection Gear Co., vice-president; J. H. CATTELL, Warner-Patterson Co., secretary; and C. P. BREWSTER, K-D Mfg. Co., treasurer.

D. D. BUCHANAN has been appointed manager of operations of the Union Drawn Steel Div., Republic Steel Corp., at Massillon, Ohio.

WILLIAM H. WINTERROWD, former vice-president Franklin Railway Supply Co., Chicago, and a recently elected manager of the A.S.M.E., has been elected vice-president in charge of operations, Baldwin Locomotive Works, Eddystone, Pa.

F. G. CARRELL, vice-president Calumet Steel Co., Chicago, has been named general manager of the Franklin Steel Works, Franklin, Pa.

F. E. CONNAIR has been appointed plant engineer, Inland Mfg. Div., General Motors Corp., Dayton, Ohio, it was announced reecntly.

M. E. CUMMINGS, former manager of the Sanderson Works, Crucible Steel Co. of America, New York, N. Y., has been appointed manager of the Syracuse district. G. D. MOOMAW has been named assistant district manager.

FREDERICK W. COPELAND, vice-president in charge of sales, H. Channon Co., has resigned to become president of the Sullivan Machinery Co., Chicago, Ill.

A. G. DELANY, former maintenance superintendent, Gulfsteel Div., Republic Steel Corp., has been appointed assistant district manager. G. H. DAVIS will head Gulfsteel's mechanical department, and C. R. FLETCHER will serve as mechanical general foreman.

THOMAS DREVER, vice-president and treasurer American Steel Foundries, Chicago, was elected president at a meeting of the board of directors Jan. 19. He succeeds GEORGE E. SCOTT, who died Jan. 11.

RALPH EVINRUDE has been elected president Outboard, Marine & Mfg. Co., Waukegan, Ill., it was announced recently. S. F. BRIGGS was elected chairman of the board.

LOUIS W. FALK has been named executive engineer, the Falk Corp., Milwaukee, Wis. W. P. SCHMITTER has been appointed chief engineer. HAROLD S. FALK, vice-president, continues in his present capacity as director of engineering.

BYRON C. FOY, vice-president Chrysler Corp. and secretary Automobile Manufacturers Association, has been elected a director of the United Aircraft Corp., it was announced recently by DONALD L. BROWN, president.

EDWARD J. GLEASON, assistant manager of the Fisher Body plant in Cleveland, has been appointed manager. He succeeds LINCOLN R. SCAFE, who resigned recently.

ARTHUR R. HEISE, chief engineer Wm. Schollhorn Co., New Haven, Conn., hand tool specialties manufacturer, has been appointed general manager.

C. W. HEPPENSTALL, since 1920 president and treasurer Heppenstall Co., Pittsburgh, was elected chairman at a recent meeting of the board of directors. R. B. HEPPENSTALL, formerly vice-president and general manager of sales, has been elected president. His duties will be assumed by S. B. HEPPENSTALL, JR., who has been assistant manager of the sales department. C. W. HEPPENSTALL, JR., former general manager, has been made vice-president in charge of operations. G. F. RITENBAUGH, secretary, has also been made treasurer.

NEIL C. HURLEY, JR., for the past four years secretary Independent Pneumatic Tool Co., Chicago, was elected vice-president at a special meeting of the board of directors Jan. 10.

COL. JOHN H. JOUETT, treasurer National Aeronautic Association and former Army Air Corps officer, was recently elected president of the Aeronautical Chamber of Commerce of America at the organization's annual meeting. Also elected were: ROBERT GROSS, president Lockheed Aircraft Corp., Burbank, Calif., vice-president; W. T. PIPER, president Piper Aircraft Co., Lockhaven, Pa., vice-president; C. G. TAYLOR, president Taylor-Young Airplane Co., Alliance, Ohio, secretary; and FRANK J. WALSH, Passaic, N. J., treasurer and assistant secretary.

C. A. MCDOWELL, former superintendent of rolling mills, Pittsburgh Steel Co., has been named assistant superintendent of bar mills, Gary works, Carnegie-Illinois Steel Corp. J. FRANK FRAIN, since 1934 general superintendent, Babcock & Wilcox Tube Co., has been appointed assistant superintendent of the merchant bar mills at Gary.

JOHN J. O'BRIEN, president South Bend Lathe Works, South Bend, Ind., has established a research fellowship in metallurgy at the University of Notre Dame, in the form of a joint gift to be designated as "The Miles and John J. O'Brien Fellowship in Metallurgy and Allied Sciences."

ALLEN C. SECOR has resigned as superintendent of the Standard Stoker Co., Erie, Pa.

CARL A. OSTLING, former head of the Pontiac Div., General Motors Corp., has been appointed vice-president in charge of production at the Syracuse, N.Y., plant of the Carrier Corp. He succeeds L. R. BULWARE, since 1936 vice-president and general manager, who resigned recently.

CHARLES W. PEARSON, vice-president and sales manager of the Buffalo Foundry & Machine Co., has been appointed executive vice-president and general manager.

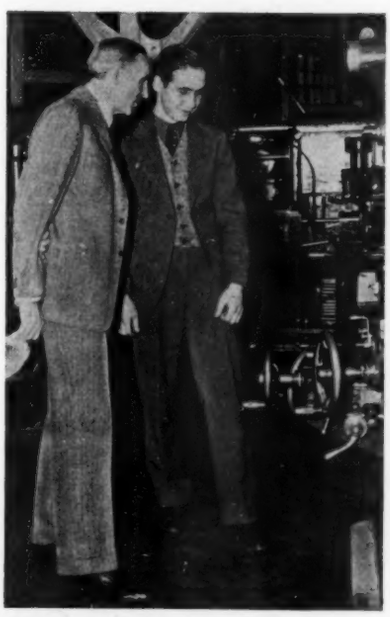
FRED L. MCCARTY, since 1935 president R. Hoe & Co., printing press manufacturer, has resigned. An operating committee composed of four directors has been appointed to head the concern's management.

FRED E. BISHOP has been appointed general sales manager Graham-Paige Motors Corp., Detroit, Mich.

R. I. PETRIE, a former executive of the Kelvinator Corp., Detroit, was recently elected president and general manager, Barlow & Selig Mfg. Co., Ripon, Wis. He succeeds R. C. STUART, who was elected chairman of the board.

J. W. ROBINSON has been appointed assistant manager of sales of the hot rolled products department of the Jones & Laughlin Steel Corp., Pittsburgh, it was announced recently. Mr. Robinson was previously connected with the Detroit sales office.

C. I. PACKER, president Packer Machine Co., Meriden, Conn., has been elected president of the Meriden Manufacturers' Association.



From the Ground Up—*Henry Ford extends a personal welcome to Ralph O. Lill, the 2,500th student to enter the Ford apprentice training school. He plans to learn tool and die making*

FRANK H. STOHR

FRANK H. STOHR has been appointed manager of all industries sales departments of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., according to a recent announcement by RALPH KELLY, vice-president. Prior to his recent appointment, Mr. Stohr was manager of the recently combined transportation and generator divisions.

Mr. Kelly also announced the appointments of R. A. NEAL as assistant to the vice-president, C. F. LLOYD as central station sales department manager, and W. A. FURST as coordinator of navy and maritime activities.

HARRY J. PORTER, former vice-president Timken Roller Bearing Co., has resigned after 27 years of service.

W. W. SEBALD, vice-president American Rolling Mill Co., Middletown, Ohio, has announced the following personnel changes in the company's Sheet & Strip Sales Div.:

F. A. TOBITT, enameling-sheet sales manager, has been made manager of Eastern sales; J. A. INGWERSEN, manager of hot and cold rolled sales, has been made manager of Midwestern sales; G. W. BREIEL, manager of galvanized and long terne sales, has been appointed manager of Southern and Western sales.

D. S. SWAYZE, former superintendent of the Anderson, Ind., plant of the Delco-Remy Div., General Motors Corp., has been appointed general manager of the corporation's Delco Radio Div. plant in Kokomo, Ind. He succeeds RAY ELLIS, who is now Delco Radio sales manager.

RALPH A. TERRELL, formerly with the Boyar-Schultz Corp., Chicago, Ill., has joined the Tool Equipment Sales Co., Chicago.

JOHN WISEMAN, manager of the Brooklyn, N. Y., yards of the Bethlehem Shipbuilding Corp., has been appointed general superintendent of the company's yards in Quincy, Mass.

BUSINESS ITEMS

Detroit Compensating Axle Corp. has changed its name to Differential Wheel Corp., it was announced recently. Final approval of the change was granted at a recent stockholders meeting in Jersey City, N. J.

The General Electric Co. has purchased 77,000 sq. ft. of land in Chicago for the erection of a modern building to house the company's Chicago headquarters, it was announced recently by W. O. BATCHELDER, commercial vice-president. Work will soon be started on the building which will provide space for the General Electric sales offices, warehouse and service shop. An expenditure of approximately $2,500,000 is involved.

Inland Steel Co. officials have announced that a merger with the Wilson & Bennett Mfg. Co., Chicago barrel maker, has been agreed upon, subject to final approval by the stockholders. Said to be the largest manufacturer of steel barrels and pails in the country, Wilson & Bennett has plants in Chicago, Ill., Jersey City, N. J., and New Orleans, La. The concern, which was founded in 1909, is headed by STEVENS A. BENNETT as chairman of the board and presided over by HARRY M. GUSTOFSON.

The Seaboard Air Line Railway has placed an order with the Tennessee Coal, Iron & Railroad Co. for steel rails and track accessories costing about $500,000. Included in the order are 8,000 tons of 100-lb. rail, according to L. R. POWELL, JR., co-receiver of the railroad.

The Southern Railway has ordered from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., electrical equipment for six diesel-electric streamlined trains to be placed in service this summer. The order involves an expenditure of over $100,000.

The Truscon Steel Co. has begun construction of a new mesh and fabric plant at the Gadsden, Ala., plant of the Republic Steel Corp.

The John Waldron Corp., New Brunswick, N. J., manufacturer of gear-type flexible couplings, has appointed the Dingle-Clark Co. as its representative in Cleveland, Pittsburgh and Philadelphia.

Weirton Steel Co., Weirton, W. Va., has started construction of a $250,000 chemical, metallurgical and research laboratory, according to a recent announcement by T. E. MILLSOP, president. The structure is scheduled to be completed by Aug. 1.

The Youngstown Sheet & Tube Co., Youngstown, Ohio, has been licensed by the Inland Steel Co., to manufacture "Ledloy" free-machining steel under the Inland patent, it was announced recently.

CARL F. LOMB

ALBERT SAUVEUR

OBITUARIES

CARL F. LOMB, vice-president Bausch & Lomb Optical Co., Rochester, N. Y., died Jan. 26 at his home in that city following an extended illness. He was 84 years of age.

Born in Germany in 1854, Mr. Lomb came to the United States at the age of 19 and joined the New York banking firm of Jay Cooke & Co. Shortly thereafter he became associated with Bausch & Lomb Optical Co. in its New York office. Later he went to Rochester, where he secured a position with the Rochester German-American Insurance Co. He was made secretary of the insurance firm in 1882, and in 1891 was elected a director.

Mr. Lomb rejoined Bausch & Lomb in 1910, and subsequently was made a vice-president, a position which he held until his death.

Mr. Lomb was one of the founders of the Mechanics Institute of Rochester, of which he had been president since 1915.

WILLIAM P. BRADBURY, 53, vice-president and sales manager of the Consolidated Hancock Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn., locomotive equipment manufacturer, died Jan. 14 in Baltimore, Md. He had been associated with the company for 37 years, becoming sales manager in 1923 and vice-president in 1930.

BERNARD E. ELSHOFF, 69, works manager Diehl Mfg. Co., division of the Singer Mfg. Co., Elizabeth, N. J., died Jan. 17 in Orlando, Fla., following a heart attack.

Mr. Elshoff became associated with the electrical industry as a young man when he joined the Bullock Electrical Co., of Cincinnati. He later worked with the Allis-Chalmers Mfg. Co. in Milwaukee and with the Westinghouse Electric & Mfg. Co. in Hamilton, Ont. The first two 7,500-kw. alternators for the Hydraulic Power Co. at Niagara Falls were built under his direction.

ALBERT SAUVEUR, Harvard University professor emeritus of metallography and metallurgy, died in Boston, Jan. 26 following a week's illness. He was 75 years of age.

One of the world's foremost authorities on the metallurgy of iron and steel, Professor Sauveur was widely credited as being the "founder of the science of metallography." In 1924 he received from the Iron and Steel Institute of Great Britain the Bessemer Gold Medal, regarded as the highest award to which a steel metallurgist may aspire. In 1934 he received the first Albert Sauveur achievement medal from the American Society for Metals.

In 1900, he became assistant professor of metallurgy and metallography at Harvard, and in 1905 was made Professor of Metallurgy. In 1924 he was made Gordon McKay Professor.

JOHN J. CORCORAN, treasurer Detroit Metal Spinning Co., died at his home in Detroit Jan. 16.

ARTHUR MURRAY HANCOCK, 64, treasurer G. W. Griffin Co., Franklin, N. H., hack saw manufacturer, died Jan. 11.

WILLIAM P. KENNEY, since 1932 president Great Northern Railway, died Jan. 24 at St. Joseph's Hospital in St. Paul, Minn. He was 69 years of age.

ROBERT C. LANPHIER, Sr., founder and president Sangamo Electric Co., Springfield, Ill., manufacturer of electric meters, died Jan. 28 at his home in that city following a long illness. He was 61 years of age.

F. RODGER LINDSAY, sales manager Swind Machinery Co., Philadelphia, Pa., was killed in an automobile accident Jan. 29. He was 35 years old.

JOHN M. LOCKHART, 73, chairman of the board of the Lockhart Iron & Steel Co., Pittsburgh, and a director of the Westinghouse Air Brake Co., died at his Pittsburgh home Jan. 23.

WILLIAM E. SHAW, 74, president Western Block Co., Lockport, N. Y., manufacturer of tackle blocks, pulleys and similar equipment, died recently in Phoenix, Ariz., of heart disease.

FRED O. SMITH, vice-president Vulcan Iron Works, Wilkes-Barre, Pa., manufacturer of locomotives, and president Wilkes-Barre Mfg. Co., died Jan. 21 at his home in that city, following an attack of indigestion. He was 62 years of age.

CHARLES F. WETTERER, vice president Stone & Webster Service Corp., New York, N. Y., died in Melrose, Mass., Jan. 24. He was 54 years of age.

MEETINGS

AMERICAN ELECTRO-PLATERS' SOCIETY. International convention, Asbury Park, N. J., June 19–22. W. J. R. KENNEDY, executive secretary, 90 Maynard St., Springfield, Mass.

AMERICAN IRON AND STEEL INSTITUTE. General meeting, Hotel Waldorf-Astoria, New York, N. Y., May 25. Executive secretary, WALTER S. TOWER, 350 Fifth Ave., New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION. Annual personnel conference, Palmer House, Chicago, Ill., Feb. 15–17.

Ninth annual conference and exposition of packaging, packing and shipping, Hotel Astor, New York, N. Y., March 7–9.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. Annual meeting, Palmer House, Chicago, Ill., March 14–16. W. S. LACHER, Secretary, 59 E. Van Buren St., Chicago, Ill.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting, St. Charles Hotel, New Orleans, La., Feb. 23–25.

AMERICAN SOCIETY OF TOOL ENGINEERS. Annual meeting and Machine & Tool Progress Exhibition, Convention Hall, Detroit, Mich., March 14–18. FORD R. LAMB, executive secretary, Room 428 Boulevard Temple Bldg., 2567 W. Grand Blvd., Detroit, Mich.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting and exhibit of apparatus and instruments, Chalfonte-Haddon Hall, Atlantic City, N. J., June 26–30. R. E. HESS, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

MOTOR AND EQUIPMENT MANUFACTURERS ASSOCIATION. Automotive maintenance show, Palace of Fine Arts, San Francisco, Calif., Feb. 23–26. Manager, J. M. Noble, 1243 S. Hope St., San Francisco, Calif.

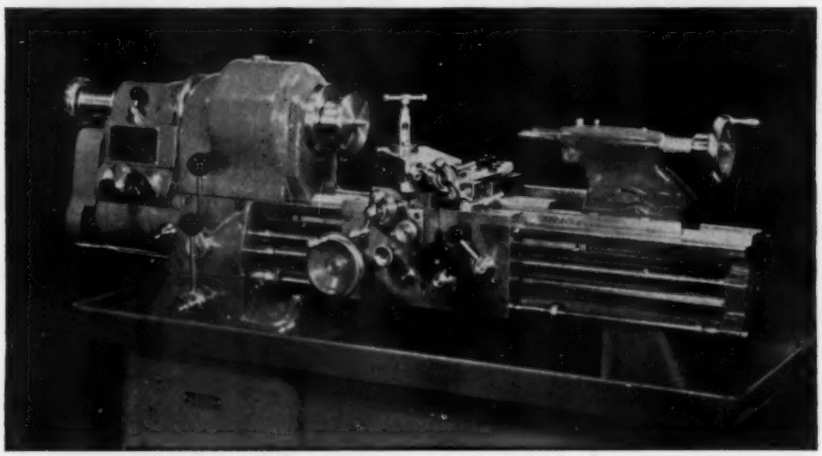
SOCIETY OF AUTOMOTIVE ENGINEERS. National aeronautic meeting, Washington, D.C., March 16–17.

World automotive engineering congress. Hotel Pennsylvania, New York, N. Y. May 22–28, Hotel Statler, Detroit, Mich., May 31-June 8. Hotel Fairmont, San Francisco, Calif., June 6–8.

SHOP EQUIPMENT NEWS

"Cataract" Precision Toolroom Lathe Provides Wide Speed Range

Designed primarily to fill the long existing gap between the plain precision bench lathe and the toolroom engine lathe, the Type TL "Cataract" pedestal cabinet type, back geared, quick change screw-cutting precision toolroom lathe combines the accuracy, speed, high finish qualities and convenience of a precision bench lathe with the screw cutting facilties, power and ruggedness of an engine lathe. Offered by Hardinge Bros. Inc., Elmira, N. Y., this lathe has a swing of 9 in. and will take work 15¾ in. long between centers with the tailstock flush. This distance can be increased to 19 in. with the tailstock overhung. The ball bearing mounted spindle permits a speed range of 170–1750 r.p.m. and the back gears, also mounted on anti-friction bearings, reduce the speed 6¼ times to obtain a low speed of 26 r.p.m. The bed, after being finish machined, is mounted on three balls and is held down in such a manner that no undue strain can distort it.



The quick change gear box is designed to cut 30 different threads ranging from 11 to 136 pitch to give a full range of standard threads from No. 0-80 to 1½-12 National Fine and No. 1-64 to ⅝-11 National Coarse, as well as standard threads in the American Briggs, Whitworth Standard and U. S. National Extra Fine pitches. This range is obtained without removing or adding any gears. Threads obtainable from the quick change gear box include 11½ and 27 pitch for the U. S. S. Pipe Standards. By the use of compound gears in combination with the quick change gear box, the lathe will cut every thread from 1 to 100, every other thread and all threads divisible by five from 100 to 150, and every thread divisible by ten from 150 to 250. A translating set of gears on a special, interchangeable sector permits the cutting of desired metric threads. Feeds range from 0.001 to 0.015 in.

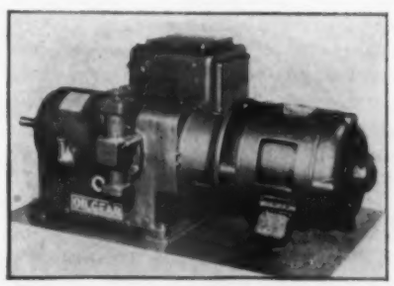
The carriage hand feed consists of a handwheel provided with a friction dial which can be set at zero and is graduated in $\frac{1}{64}$ in. for recessing and counter-boring operations. The power feed handle is interlocked with the screw engaging nut to prevent both power feed and nut being engaged at the same time. Tool post slide is mounted directly on the solid swivel base, which in turn is solidly mounted on the cross slide. The top slide screw is provided with a quick-acting device for withdrawing the tool when cutting threads.

When mounted on the pedestal cabinet drive, this lathe has a center height of approximately 47 in., a convenient height for most workmen. At the headstock end are two control levers so placed that the operator may reach them conveniently. One is connected to the carriage feed and gives instant forward-stop-reverse to the feed. The other handle is electrically connected to the motor and gives an instantaneous change of two speeds forward or two speeds reverse to the spindle. When placed in the center or stop position, this lever operates a mechanical spindle brake.

Specifications: collet capacity 1-in. round stock; maximum diameter of stock to be passed through live spindle, $1\frac{3}{16}$ in.; swing over cross slide, 6 in.; swing over tool post slide, 2¼ in.; length of bed, 38¼ in.; net weight with standard equipment, approximately 1,000 lb.; travel of tailstock spindle, 3½ in.; maximum taper cut with taper attachment, 7 deg.; length of taper cut, 8 in.; floor space required for the complete lathe with pedestal stand, 26 x 52 in. The pedestal stand is arranged with space for storing chucks, tools and collets, and there is a door at the front to permit access to the motor for oiling.

"Oilgear" Offers New Variable-Speed Drives

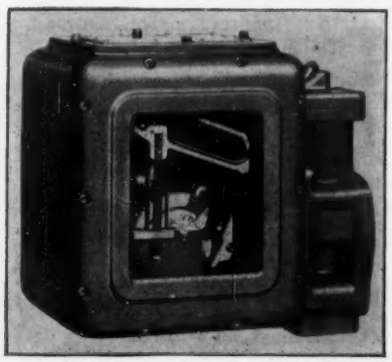
Comprising a standard fluid-power transmission with a micro servo-motor stroke control cylinder to adjust the pump stroke so as to give exactly the required hydraulic motor speed, these



The Oilgear Type DT precision speed control transmission is said to hold pre-set speeds within plus or minus 0.25 per cent of rated speed

precision variable speed drives developed by the Oilgear Co., 1319 W. Bruce St., Milwaukee, Wis., are claimed to give precisely the desired speed regardless of changes in load, voltage, frequency, speed of drive, oil temperature or running fits. Oil is admitted to the control cylinder by a pilot valve, actuated by a small differential unit which continuously compares the hydraulic motor speed with time, or with the speed of any desired master unit. Each unit drive may be controlled directly by a small synchronous motor or pendulum to give absolute speed, or by any master unit or roll stand where a precise speed ratio with any other unit is required.

Pre-set speeds are held within plus or minus 0.25 per cent of rated speed when load changes are gradual. One of these units, when driven by an ordinary induction motor or a line shaft, will drive its load at any desired speed, either constant, adjustable, or continuously varying anywhere between zero and maximum. The differential-time control unit is the heart of this system. The hydraulic motor, driven by the flow of power from its variable stroke pump, simultaneously transmits the resulting speed back to a differential comparator. This differential also receives a standard or master speed from a small synchronous motor or pendulum, or from some other unit. In any case, the differential continuously compares the actual speed with the master speed and translates every discrepancy into the increase or decrease of pump discharge necessary to correct the error. The action of the disk type control is so quick that fluctuations of speeds due to ordinary load changes are said to be caught and corrected within about 0.10 sec. A feature of the drive is that it cannot be overhauled by a decelerating inertia load.



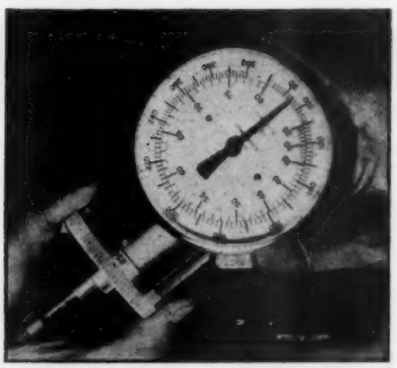
Heart of the Type DT precision speed control transmission is the differential-timed control unit

"Micro-Poise" Balancer Includes a Drill Unit

The Commerce Pattern Foundry & Machine Co., 2211 Grand River Ave., Detroit, Mich., has announced an improved model of the "Micro-Poise" balancing machine, which is recommended for production balancing of such units as fly wheels, fans, clutches, brake drums, grinding wheels, and other narrow-faced rotating parts. Indicated unbalance is corrected by turning the work to bring the heavy side under the drilling unit, where a feel dial is graduated to indicate the amount of metal to be removed by the drill in order to bring the part into balance.

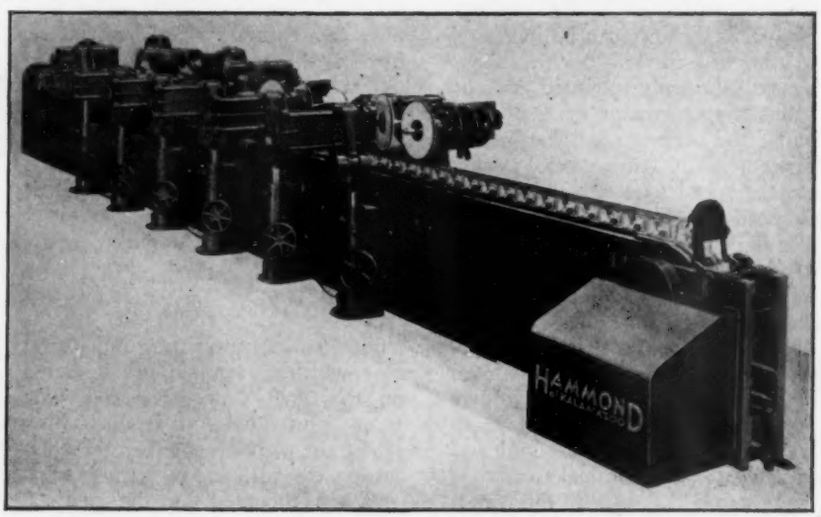
"S & S" Tachometer Has Increased Range

The "S & S" jewelled hand tachometer offered by George Scherr Co., 128 Lafayette St., New York, N. Y., is available in two models, one measuring from 30 to 40,000 r.p.m., and the other from 25 to 30,000 r.p.m. The pointer makes two turns around the dial giving readings on two sets of numerals, one for the inside scale graduations and the other for the outside. Only three range changes are necessary.



Type HD "Strait-Line" Automatic Polisher Is Equipped With Twelve Heads

A "Strait-Line" automatic polishing and buffing machine designed and constructed by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich., for finishing running board molding, is 42 ft. long over-all, and has twelve heads, each powered by 7½ hp. motor. In each head unit, the motor is mounted directly on the spindle head and wheel



speed is limited to the motor speed. Belted heads may be substituted if desired and can be operated at any desired speed.

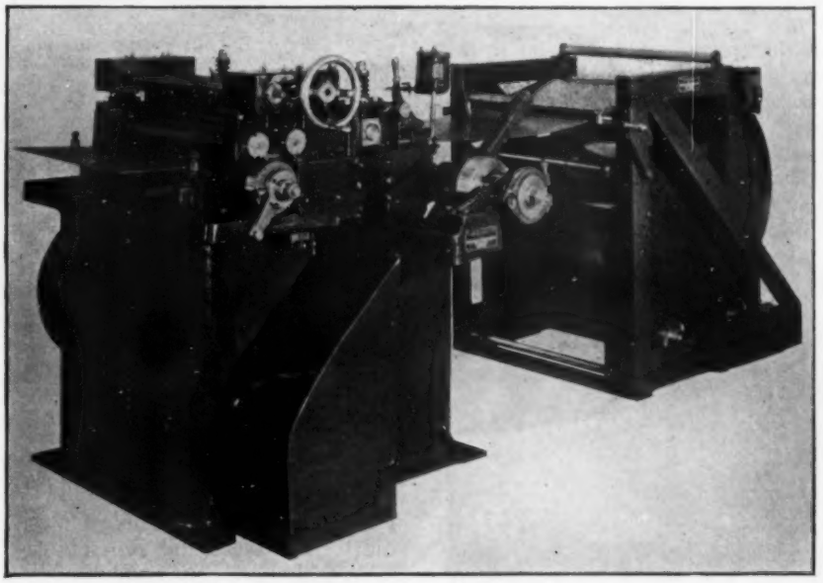
The wheel heads are balanced to insure uniform wheel pressure and are adjustable from horizontal to vertical wheel positions. All spindles are mounted on anti-friction sealed bearings. The cast-iron platens are mounted on ball bearings and travel over steel ways. They are connected to a heavy conveyor chain which is driven by a variable speed unit. All moving parts are protected so that dirt and abrasive material cannot come in contact with any wearing part. Each motor has an individual switch, but the machine also is wired with one safety switch which will stop all of the wheel motors and the drive unit.

Model D White Printer Designed For Office Use

Substantial savings in the cost of copying specificatons, records, reports, correspondence, inventory sheets, parts lists and other forms are said to be possible with the Model D white printer announced by Ozalid Corp., 354 Fourth Ave., New York, N. Y. This unit duplicates such forms on any of a wide range of sensitized materials by

transmitted light, to produce copies with black, blue or maroon lines on a white background. The operator merely feeds the original and the sensitized material into the front of the unit to complete the two simple steps of the process, which include exposure to the light of a mercury vapor lamp and dry development by exposure to ammonia vapor.

"Littell" Feed Unit Has Knurled Rolls



This press feeding and straightening unit, built by the F. J. Littell Machine Co., 4125 Ravenswood Ave., Chicago, Ill.; is entirely self-contained and is arranged to feed a predetermined length of stock directly into the punch press. It can be moved to any press and positioned at the front, back or side, as required. A remote-control station permits the operator to stand at any location and trip the machine.

Stock is fed into two pinch rolls and then through a five-roll straightener. All feeding and straightening rolls are diamond knurled to give maximum pulling power. Length of feed on this machine can be varied from 0 to 25 in., but other feed lengths can be arranged if required. The lower feed rolls are power driven.

Capacity of the machine is $\frac{1}{16}$ in. thick by 25 in. wide stock, or heavier stock in narrower widths. This machine is driven by a 2 hp. motor and has a clutch similar to that used on punch presses, so that it makes only one complete cycle when tripped. Reel used is of the standard cradle type and is equipped with a variable speed drive. It will handle coils weighing up to 3,000 lb.

"Eveready" Lifters Make Sheet Handling Safer

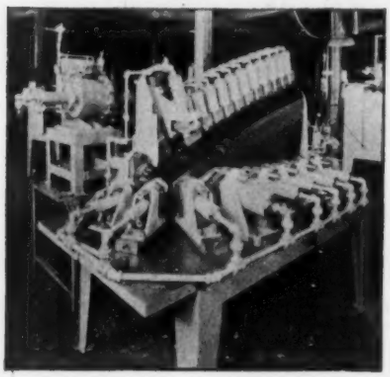
Incorporating large rubber vacuum cups, which are provided with automatic releases that work with the flick of a finger, five different "Eveready" lifters have been placed on the market by The Bastian-Blessing Co., 240 E. Ontario St., Chicago, Ill. These units make the handling of sheet metals, sheet glass and other products having a smooth surface more rapid and safer. The vacuum cups are the only parts which are subjected to wear and these can be replaced in less than five minutes without the use of special tools.

"Progressive" Announces New Punching Equipment

Improved punching and stripping equipment units, involving the combination of hydraulic pressure with balanced spring action, has been announced by Progressive Welder Co., 737 Piquette Ave., Detroit, Mich. Designed for use either individually, or in groups for multiple punching, these units are made in two types. One type is arranged for single-punch operation, and the other for multiple punching with each unit. Both types may be operated either by motor-driven pump or air-hydraulic booster up to pressures of 2,000 lb. per sq. in.

For high pressures, boosters are used.

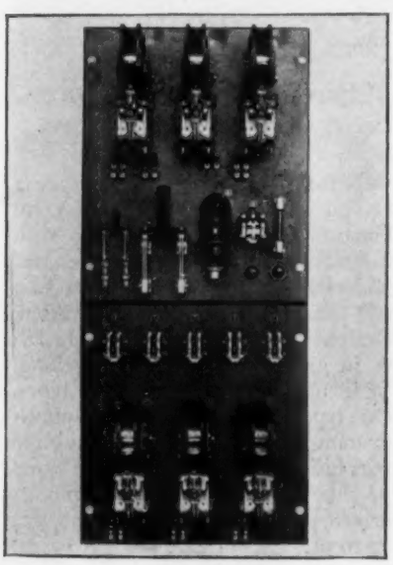
Design of the multiple-punch hydraulic unit permits the use of a single-acting piston. Close adjustment of the entire unit in relation to the work is provided at the mounting bracket. In the single punch unit, stripping is performed entirely through the action of balanced springs, the operation being completely automatic. The multiple punch unit is available either for hydraulic or mechanical stripping. An example of the use of hydraulic punching with mechanical



stripping is shown in the accompanying view of an installation for an automobile plant consisting of 20 of the mechanical stripping units mounted in a fixture to punch a total of 36 holes in one-half of a hood top.

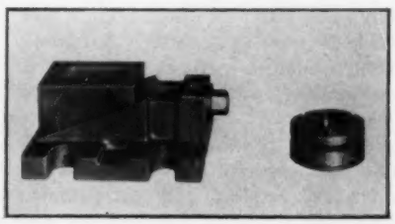
"Neo-Time" Controllers Provide Smooth Starting

The acceleration of either a.c. or d.c. motors can be controlled automatically with the "Neo-Time" acceleration control developed by the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. The "Neo-Time" principle is based on the time required to charge a condenser to a predetermined voltage. When this voltage is reached, the condenser discharges through an industrial-type Neon tube to cause the first acceleration contactor to close. When this contactor closes, the same timing circuit is re-energized to close the next accelerating contactor; this operation is repeated until the motor is operating on full line voltage. An adjustable resistor is placed in the condenser-charging circuit to provide a means of varying the time of acceleration.



Baker Leveling Jacks Made in Three Sizes

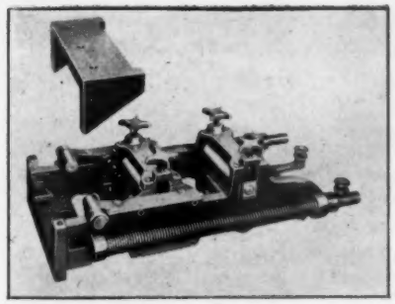
Three leveling jacks suitable for use with certain types and sizes of machine tools have been announced by Baker Bros., Inc., West Lake and Post St., Toledo, Ohio. The large No. 43 jack shown is designed for large planers and boring mills, measures 9 x 8 in. and has a slide adjustment height range of $4\frac{1}{4}$ to 5 in. This angle slide type jack also is made in



a smaller size, the No. 42, for small planers and boring mills. It measures $5\frac{3}{4}$ x 5 in. and has a height adjustment range of $2\frac{3}{4}$ to $3\frac{1}{4}$ in., by means of the angle slide adjustment screw. Lathes, milling machines and similar tools can be aligned with the round No. 41 jack, which is 4 in. in diameter, a $2\frac{1}{4}$ in. height when closed and has a screw type adjustment of $1\frac{5}{8}$ in.

Dickerman Die Feed Has Positive Control

Because it requires no connection to the power shaft of the press, the improved die feed developed by the H. E. Dickerman Mfg. Co., 284 Wilbraham Road, Springfield, Mass., can be set up at will on any suitable punch press. This is particularly advantageous for short runs or for rush work. By leaving the die feed attached permanently to dies that are

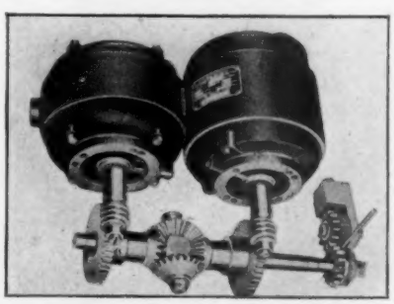


used frequently, it is possible to reduce set-up cost materially.

Feed length can be adjusted from zero to the maximum length for which the feed unit is designed in increments of 0.001 in. Feed control is positive and the absence of wearing parts maintains the accuracy of the set-up. A twin operating cam is furnished for attaching to the punch holder. Maximum feed length is 3 in. with a 3 in. press stroke and $2\frac{3}{4}$ in. with a $2\frac{1}{2}$ in. press stroke.

"Una" Welding Head Is All-Electric

Construction of the all-electric arc welding head developed by Una Welding, Inc., 1615 Collamer Ave., Cleveland, Ohio, is such that it automatically will establish the arc by first making contact between the welding wire and the work, and then withdrawing the welding wire until an arc of correct length has been formed. Operation in such that this action is as nearly instantaneous as possible. The head will maintain the pre-set arc voltage under all conditions by feeding the welding wire towards the work at a controlled rate of travel. There are no sensitive relays or con-



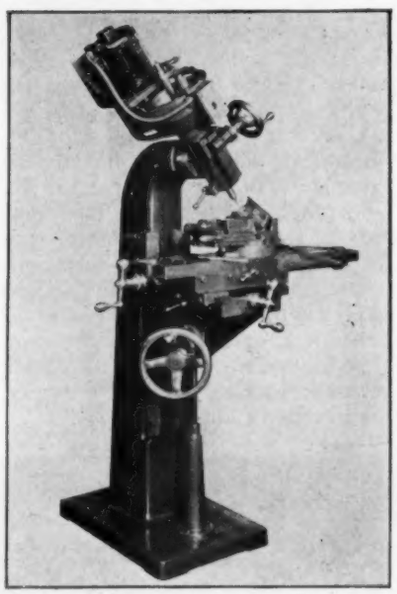
tacts in this unit and all rotating parts travel in one direction.

The head, for which the drive assembly is shown, consists of two "Ohio" electric motors which drive differential gearing so that the resultant motion at the feed rolls is a direct function of the arc voltage. The larger motor is a specially wound d.c.

motor which rotates so as to feed wire into the work while the smaller motor is a constant speed a.c. motor rotating so as to back wire up from the work. The differential gearing is such that approximately 300 r.p.m. difference in speed of the two motors will give the average speed to the electrode. Variations in the speed of the d.c. feeding motor of only 600 r.p.m. will change the full forward speed of the electrode to full speed reverse.

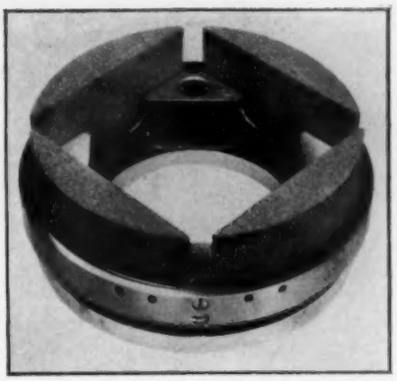
"Index" Vertical Mill Now Has Movable Quill

The No. 39 high-speed vertical milling machine designed and built by Index Machine Tool Co., Jackson, Mich., has the same features as the No. 38 machine, with the exception that the milling head is equipped with a movable quill that can be used for drilling and boring on angles. This quill has 3¼ in. travel. The No. 38 machine could only be used for



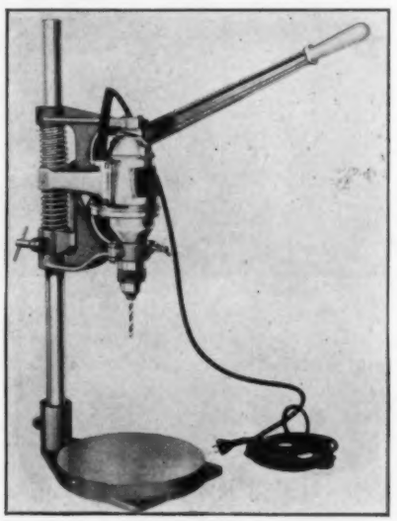
drilling with the head in a vertical or horizontal position. Hand feed is provided for all directions of table movement. Draw-in collet attachment, collets, sleeves, dividing heads, circular tables and adjustable angle tables are available for this machine.

Specifications: Capacity, 3/32 to ⅝ in. end mills in tool steel; spindle speeds, 375, 550, 775, 1,150, 1,850 and 2,820; hand feeds, longitudinal 16 in., cross 8 in., vertical 12¾ in.; distance from center of spindle to column, 8¼ in.; distance from end of spindle to table, 0-12¾ in.; working surface of table, 8 x 22 in.; height over-all, 68 in.; floor space, 36 x 57 in.; net weight, 850 lb.; motor, ⅓ hp.



Cortland Segmental Chuck For Surface Grinders

Made in three sizes for Pratt & Whitney and Blanchard surface grinders, the segmental wheel chuck announced by Cortland Grinding Wheels Corp., Chester, Mass., is designed to grip the segments at the center, rather than at their base. No safety band is required with this chuck. Only one resetting is required as the segments wear down. Shape of the segment is claimed to insure a shearing action in grinding, which gives rapid stock removal with little tendency to burn the work. Segments can be removed and changed at will from a single permanently mounted chuck on the spindle of the machine.



Drill Stand Holds Portable Drill

Signal Electric Mfg. Co., Menominee, Mich., has developed the Type DS-5 bench drill stand for converting the Type OB-5 electric drill of ½ in. capacity into a convenient, stationary bench-type drill press. This stand is 32⅜ in. high above the base, which is 11 in. in diameter and has a 1½ in. diameter column.

"Fit-Over" Goggles Have Lift-Front

Hinged-frame goggles that fit over prescription glasses and swing up out of the way without removing the headband and without disturbing the regular glasses are offered by Sellstrom Mfg. Co., 615 N. Aberdeen St., Chicago, Ill. Listed as the No. 225 fit-over goggle, this unit features a lift-front design that permits swing-

ing the goggle up away from the face when not in use.

Head harness is fully adjustable and a black fabric cap snaps over the front of the headband to protect the forehead and hair. Headband is made of black fiber and is adjusted by a large knurled nut in the back. All metal parts of the frame are finished in flat black to prevent light reflecting into the eyes. Lens size is 50 mm. to provide full vision.

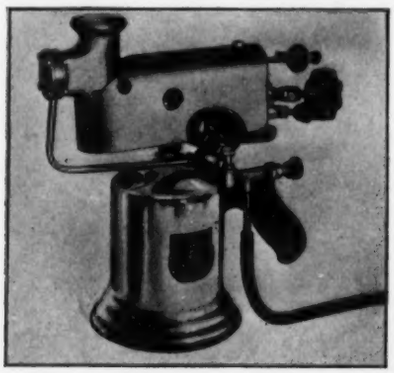
"Ideal" Etcher Marks Iron and Steel Parts

Legible, permanent markings can be made on iron and steel parts, including parts made from hardened steels, with the small electric etcher developed by the Ideal Commutator Dresser Company, 1057 Park Ave., Sycamore, Ill. This etcher is used in the same manner as a pencil and

includes a hand piece with alloyed points, a transformer with three taps, a special primary cord with tap-changing switch, secondary leads and a work plate. Weight is 12 lb. Three etching speeds are available, being controlled by the tap-changing switch on the primary cord. Depth of the etch is governed by the speed at which the point is moved over the metal surface. Standard unit is for 110 volts, 60 cycle service.

"Turner" Spray Gun Uses Gasoline Torch

Heat for the "Turner" metal spray gun is furnished by a gasoline-fired blow torch. It is suitable for use with all lead-tin alloys, and is designed to hold a reserve of molten metal to maintain temperature under heavy



use. Made by the Turner Brass Works, Sycamore, Ill., this gun is claimed to be especially suitable for covering non-metallic objects for plating and oxydizing, and for automotive body work. Any standard rods or bars of solder may be used. Control provides a change of spray from fine to coarse as desired.

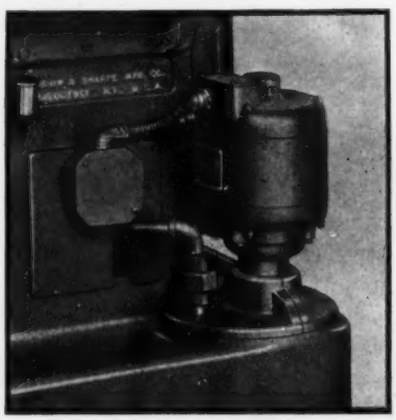
Universal Sander Has Gear-Shift Feature

Changing from one sanding speed to the other is accomplished easily in the "CP" two-speed universal electric sanders offered by Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Instead of using a separate gear-shift lever and a starting switch, there is located in the switch handle one plainly marked button for each speed. Two corresponding sets of

gears are always in mesh with the driving pinion and, when the selected button is pressed, the speed is changed electrically without loss of power. The No. 940-TAS sander was developed to meet the needs of industrial users for a machine in the two-speed class for 7 and 9 in. sanding. The No. 951-TAS sander is identical in design and operation, except that it is of higher capacity for continuous production service under severe conditions. The standard sander has free speeds of 2,500 and 4,000 r.p.m., while the heavy-duty sander has free speeds of 2,700 and 4,300 r.p.m.

No. 205 "Motorpump" For Small Spaces

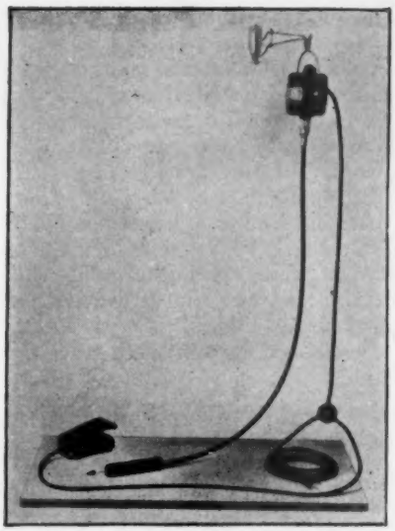
Having a depth of submergence of only 6¼ in., the No. 205 centrifugal "Motorpump" offered by the Brown & Sharpe Mfg. Co., Providence, R. I., is particularly suitable for compact installations in the bases of machines where the height is restricted. It is identical in performance, capacity and electrical characteristics to the No. 206 "Motorpump" previously announced and is available with a number of different motors to suit the requirements of most electrical installations. This pump is suitable for



supplying coolant where dirt or abrasives may be present in the liquid and where a moderate volume of flow is desired at a low head.

"Redcap" Grinder Has Molded Handpiece

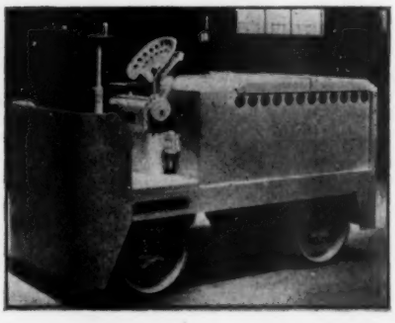
Powered by a $\frac{1}{16}$ hp. universal-type motor, which is connected to the handpiece by a 37-in. long flexible shaft, the "Redcap" grinder offered by the Lea-Nard Co., 96 Warren St., New York, N. Y., has a maximum speed of 12,500 r.p.m. The handpiece has a case of laminated linen-base bakelite fitted with molded caps. It is equipped with SKF ball bear-



ings, and with a No. 0 balanced Jacobs chuck of $\frac{1}{8}$ in. maximum capacity. A rheostat pedal control is available for use with this tool. Net weight is 8 lb.

Type TQ Tractor Has Four-Wheel Drive

Especially adapted to the hauling of heavy loads on trailers, the Type TQ heavy-duty tractor announced by Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio, has an ultimate draw bar pull of 3,500 lb., and has four-wheel drive and four-wheel steer. The drive controller is of the four-speed, heavy-duty horizontal double drum fully-inclosed type and the power circuit is shut off when the operator leaves the seat. The controller is designed to provide dynamic braking for safe operation of the tractor on ramps.



"Skullgard" Shield Has Safety Helmet

A standard cap-type "Skullgard" is combined with an improved one-piece welding shield in a unit just announced by Mine Safety Appliances Co., Braddock, Thomas and Meade St., Pittsburgh, Pa. This unit is available in standard head sizes

GULF RESEARCH TECHNICIANS develop improved lubricants . . . help industry reduce operating costs!

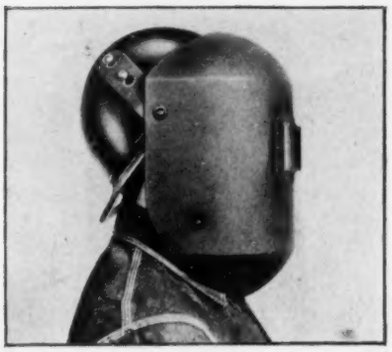
PICTURED above is a typical scene in the Gulf research laboratories. Gulf technologists, in this instance, are working with an experimental Diesel engine, studying Diesel lubrication problems. Nearby, another exhaustive research goes forward on the lubrication of a modern type of textile spindle. In the next room a railroad car bearing is being run under precisely the speed and load conditions of actual service. And a host of other lubrication problems —many of them born of our rapidly advancing mechanical age—are being studied each day by Gulf's large staff of scientific men.

To what end is this extensive research work carried on? What is its objective? By perfecting better lubricants, and better methods of applying them, Gulf is doing its part to *help industry reduce operating costs*—save money on maintenance and power, improve production and make the machinery for which you paid real money last longer.

These Gulf technologists are examining pistons and rings removed from the experimental Diesel engine shown above, after an extended period of operation. They find that ring sticking, cylinder wear, ring wear, gum formation and objectionable deposits have been minimized by the proper use of the right grades of Gulf's higher quality Diesel lubricants.

Your machinery, old or new, will be better prepared to give you the efficient production you need when you protect it with Gulf's higher quality oils and greases. Available to you, through more than 1100 warehouses in 28 states, is Gulf's complete line of 400 quality oils and greases . . . and the services of an experienced Gulf lubrication engineer. Ask him to recommend proper lubrication for your equipment. GULF OIL CORPORATION, GULF REFINING COMPANY, PITTSBURGH, PA.

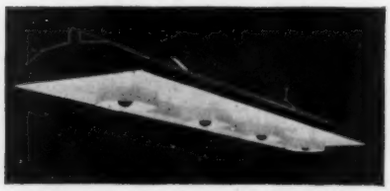
GULF INDUSTRIAL LUBRICATION



from 6 to 8 inclusive. It is recommended for use where over-head hazards are general. The Skullgard has a rubber-cushioned head band and may be quickly removed from the welding shield and worn peak forward separately for other work when desired. The welding shield has a leak-proof lens holder.

"Light-Hood" Provides Indirect Lighting

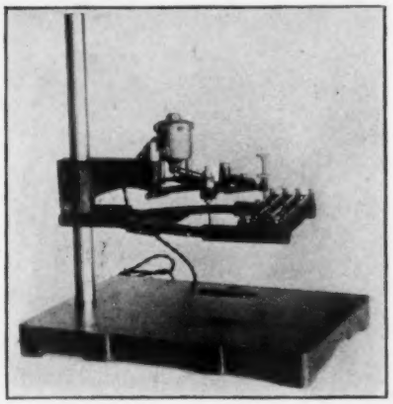
Arranged for use with the silvered bowl lamp, the improved "Light-Hood" illuminator announced by Curtis Lighting, Inc., 1123 West Jackson Blvd., Chicago, Ill., is claimed to produce high intensity uniform light over a large area with low



brightness and a minimum of glare. Since the silvered bowl lamp includes an efficient reflector, this light-hood does not have a reflecting trough. It has, however, a louver to shield the bright lamp neck from view. Using four 200-watt standard silvered bowl lamps on 30-in. centers in a 10-ft. section of "Light-Hood" provides between 85 and 100 foot-candles of light.

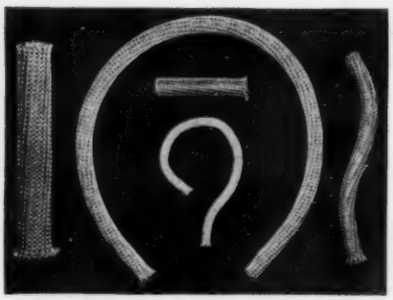
Model B Engraver For Large Panels

Large panels, which frequently require engraving at various locations on their surfaces, can be marked with the No. 250 engraver when mounted on a Type B base, instead of the smaller base with which this engraver originally was supplied. The Model B unit, recently announced by Mico Instrument Co., 10 Arrow St., Cambridge, Mass., uses the standard three-line copy carrier, so that 25 to 27 characters of standard size type can be assembled in each line. A constant depth device is available for use with this unit.



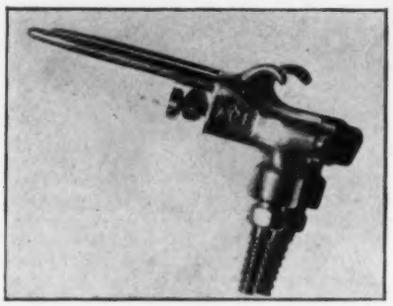
Knitted Wire Tubing Has Many Applications

Made with one strand of wire into resilient rows of interlocking loops, forming a seamless, continuous tube, the knitted wire tubing offered by E. H. Titchener & Co., Walnut St. and Erie R. R., Binghamton, N. Y., can be made rigid or flexible according to requirements. This tubing can be rust-proofed, plated, coated or covered with rubber, silk or other fabrics. It is available in almost any length and diameter.



Ace Blow Gun Valve Used for Air or Water

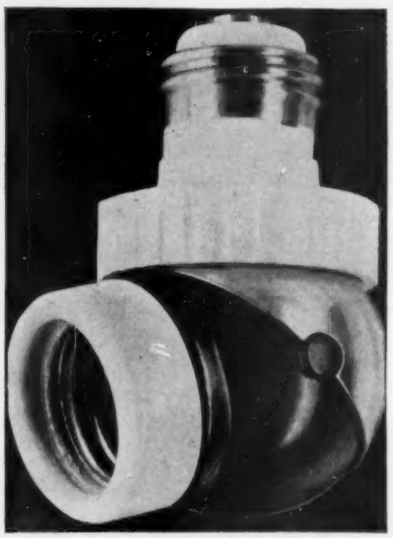
Made with two size of fittings for $\frac{1}{4}$ and $\frac{3}{8}$ in. standard pipe thread, the "Ace" air blow gun valve offered by



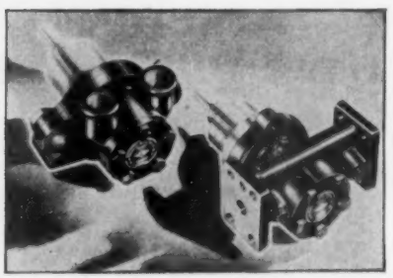
Ace Valve Co., 50 Beekman St., New York, N. Y., can be fitted with 6 or 12-in. long nozzle extensions. Nozzles of longer length can be supplied to order. This valve is designed to permit throttling so as to provide any pressure at the nozzle up to air line pressure. These valves are made of bronze and brass throughout.

G. E. Offers Adapter For Lighting Purposes

Easily inserted in any existing outlet this angle adapter, announced by General Electric Co., Schenectady, N. Y., permits projector and reflector lamps to be adjusted over a wide



range of angles, either for flood lighting or spot lighting. Vertically, the adapter permits adjustment of as much as 70 deg., and the lamp can be swung around 340 deg. horizontally to direct the light where it is wanted.



"Edco" Rotary Pumps Provide Uniform Fuel Oil Delivery

"Edco" vane-type rotary pumps, offered by the Eddington Metal Specialty Co., Eddington, Pa., feature ring assembly elements so designed as

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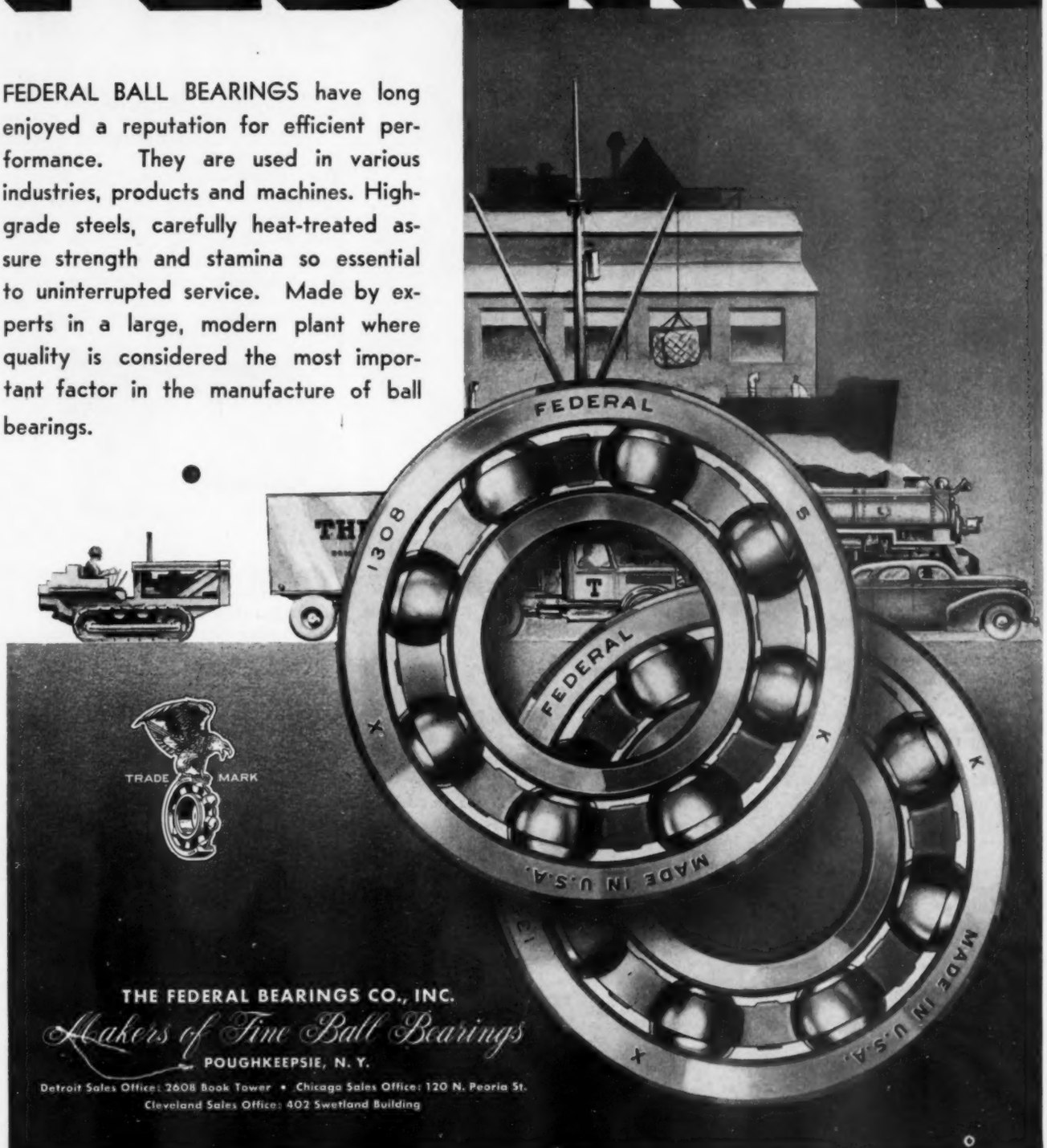
FEDERAL BALL BEARINGS have long enjoyed a reputation for efficient performance. They are used in various industries, products and machines. High-grade steels, carefully heat-treated assure strength and stamina so essential to uninterrupted service. Made by experts in a large, modern plant where quality is considered the most important factor in the manufacture of ball bearings.



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Makers of Fine Ball Bearings

POUGHKEEPSIE, N. Y.

Detroit Sales Office: 2608 Book Tower • Chicago Sales Office: 120 N. Peoria St.
Cleveland Sales Office: 402 Swetland Building

BEARINGS

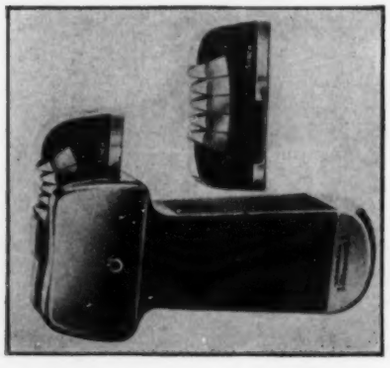
to present surfaces for engaging the underside of the vanes to maintain the latter in their effective spanning positions in order to assure constant and uniform delivery. These pumps are claimed to be practically silent, since they have no gears. They are furnished in standard capacities of 13, 20, 45 and 90 gal. per hr. at 100 lb. pressure on No. 1 fuel oil at room temperature, and 1,750 r.p.m.

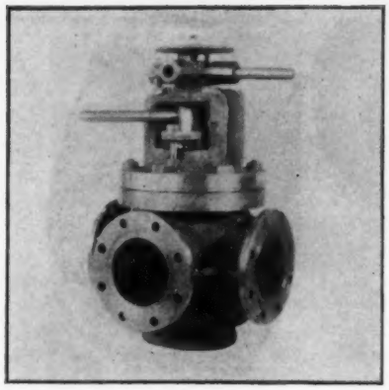
Combination Ladder

A combination ladder, that is a step ladder and extension ladder in one, has been announced by the Two-Way Saf-T Ladder Co., Green Bay, Wis. It is made in five sizes and weighs about 2 lb. per ft.

"Wedge-Grip" Holder Stamps Curved Objects

The M. E. Cunningham Co., 160 E. Carson St., Pittsburgh, Pa., has introduced a wedge-grip radius holder, employing interchangeable gear-tooth-shaped type, for stamping round or curved objects, such as pipe, shafts, gear blanks and forgings. The gear-tooth type can be used on any radius by adopting the correct slide for whatever radius is to be stamped. Only one set of type and holder is required for the various slides.



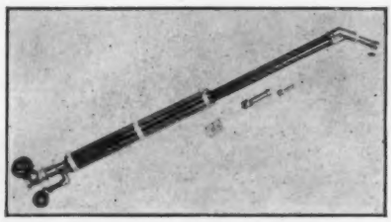


Lift-Plug Valves Have Three Port Styles

Positive opening or closing features are claimed for the new line of three-way brass easy-turn lift-plug valves developed by the Homestead Valve Mfg. Co., Inc., Coraopolis, Pa., for use on air, water, oil and gas services at working pressures up to 150 lb. and temperatures below 400 F. The valves are available in sizes from 1¼ to 3½ in., and with three different styles of port arrangement. Style D permits flow from either end and out the side opening, or vice versa; Style E permits flow from the left hand end and out the side opening or straight through; and Style F permits flow from the right hand end and out the side opening or straight through. Direction of flow is changed by a quarter-turn of the operating lever. The leverage and screw of the lift-plug feature assures easy operation, but permits the plug to be sealed in the body in either of its two extreme positions of travel or in a mid-position so that all ports are closed.

"Oakite" Steam Gun Is Self-Lifting

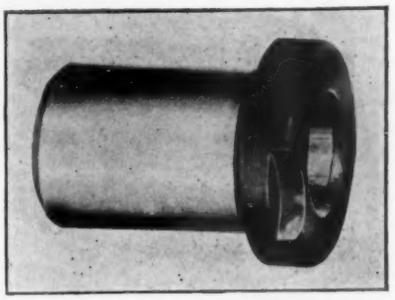
Developed especially to quickly remove heavy accumulations of dirt, grease and oil deposits from all kinds



of equipment, the improved steam gun announced by Oakite Products, Inc., 14 Thames St., New York, N. Y., will lift the cleaning solution more than 10 ft. without the use of pumps, injectors, means for gravity feed or other auxiliary apparatus previously required. All that is needed to operate this gun is the necessary steam and solution hoses, steam supply, and an open top drum or other open solution container. The gun is made in two sizes to meet individual requirements. Model No. 384 weighs 5¾ lb. and is 3½ ft. long over-all. The large No. 385 unit is 7½ ft. long and weighs 13¼ lb.

Bore of Bushings Now Super-Finished

The Universal Engineering Co., Frankenmuth, Mich., has announced two improvements in their line of drill bushings. The bore now is honed to a super-finish to improve the wearing qualities of the combined



carbon and nitrogen case. This bore also is claimed to give greater accuracy for round and straight holes. The bushing is treated with a "Black Dome" process which gives the head a jet black appearance and is claimed to reduce galling when lubrication is not present.

"Dupor" Respirator Uses Felt Filters

A twin-filter area of more than 46 sq. in. is provided in the Dupor No. 46 respirator offered by H. S. Cover, Station A, South Bend, Ind. Filters are of a special felt and are adjustable, removable and easily replaced.

Face piece is of soft rubber and will make an air-tight fit on any face. The respirator is built to withstand hard usage and can be folded to fit the pocket. Clearance is provided for goggles or spectacles.

"Airkool" Die Steel Has Wide Hardening Range

Developed to fill the need for an intermediate die steel approaching the performance characteristics of high carbon high chromium types while retaining the non-deforming and easy machining properties of oil hardening die steels "Airkool" die steel developed by Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y., offers features of greater toughness, and extremely wide safe hardening range, ability to harden well in large sections, and the simplicity of hardening by an air cool. This material has a toughness at 60 Rockwell C of 257 in. lb. as compared with 157 in. lb. for oil hardening die steels and 78 in. lb. for high carbon high chromium die steels, when determined by the falling weight method on an unnotched specimen. It is approximately 25 per cent more difficult to machine than carbon tool steel, but is easier to machine than the high carbon high chromium variety. "Airkool" is an air hardening chrome molybdenum vanadium steel which is hardened from 1750–1850 F. in air.

TRADE PUBLICATIONS

BABBITT METAL "Glyco" Babbitt Metal is discussed in an eight-page bulletin offered by Joseph T. Ryerson & Son, Inc., 16th and Rockwell St., Chicago, Ill.

BORING Ex-Cell-O Corp., 1224 Oakman Blvd., Detroit, Mich., provides specifications of Style No. 56 three-way, and Style No. 54, two-way precision boring machines in Bulletin No. 11481.

CABLE SPLICING A 16-page illustrated booklet issued by the General Electric Co., Schenectady, N. Y., gives detailed instructions for splicing and vulcanizing the principal types of rubber-insulated, rubber-jacketed portable cable.

DUST CONTROL A leaflet offered by the Falstrom Co., Passaic, N. J., describes the "Dustrol" unit dust collector.

ELECTRICAL EQUIPMENT An 88-page supplement to the May, 1938, list of inspected electrical equipment has been published by the Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill.

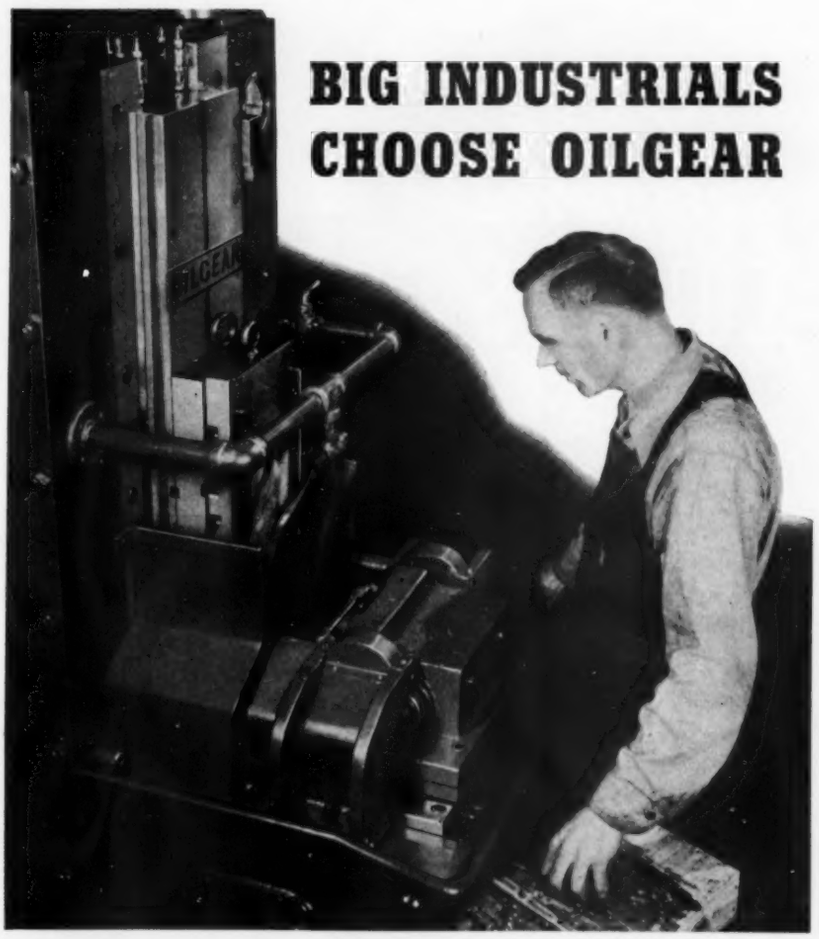
ELECTRIC HEATING Bulletin No. GEA-594B, issued by the General Electric Co., Schenectady, N. Y., discusses a line of automatic control panels for industrial electric heating.

GRINDING Catalog No. J-538, released by the Landis Tool Co., Waynesboro, Pa., contains 16 pages of illustrations and specifications concerning the 14-in. Type C hydraulic universal grinding machine.

FORGINGS A 38-page bulletin published by the Steel Improvement & Forge Co., 960 Addison Rd., Cleveland, Ohio, contains data and recommendations concerning many types of steel forgings and outlines the organization's service facilities.

GRINDING The Landis Tool Co., Waynesboro, Pa., describes and illustrates its 6-in. Type C plain hydraulic grinder in Catalog No. D-38.

GRINDING The No. 2 centerless Grinding machine is described in an eight-page illustrated folder, No. G-424, published by Cincinnati Mill-



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Rightly, production executives turn to Oilgear Broaches, Presses, Machine Tool Feeds and so on . . . . for Oilgear is the tested and proven choice of great leaders where a *better product*, a *better production means*, a *better story* of *costs cut, and wastes eliminated*, are wanted.

There are certain tests you can make . . . . but both test and testimony will lead *you, too,* back to Oilgear as the utmost in Fluid Power Machines for Industry. THE OILGEAR COMPANY, 1301 W. Bruce Street, Milwaukee, Wisconsin.

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BROACHING MACHINES AND PRESSES

ing Machine and Grinders, Inc., Cincinnati, Ohio.

HOIST MOTORS Leaflet No. A-68088, released by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes a line of motors designed to meet the requirements of such applications as cranes, hoists, and steel mill auxilaries.

LIGHTING The proper specification and installation of industrial lighting equipment is discussed in a booklet issued by the RLM Standards Institute, 20 N. Wacker Drive, Chicago, Ill.

INSTRUMENTS Folder No. G-37, released by the Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa., illustrates a complete line of indicating, recording and controlling instruments for various industrial applications.

MILLING Folder No. M-803, issued by the Cincinnati Milling Machine Co., Cincinnati, Ohio, includes illustrations and specifications concerning a line of high-speed universal milling attachments.

MOTOR STARTER The General Electric Co., Schenectady, N. Y., includes specifications of a N.E.M.A. Size 1 full-voltage magnetic motor starter in Bulletin No. GEA-2964.

PORTABLE TOOLS The 1939 Catalog of the Black & Decker Mfg. Co., Towson, Md., contains 56 pages of illustrations and specifications concerning an extensive line of portable electric tools.

PRECISION FACING Bulletin No. 11181, issued by the Ex-Cell-O Corp., 1224 Oakman Blvd., Detroit, Mich., includes specifications of the No. 12 precision facing machine.

PUMPS Folder No. W-450-B19C, released by the Worthington Pump & Machinery Corp., Harrison, N. J., describes Types QE and QAE deep well turbine pumps.

REBUILT TOOLS "Green List" No. 159, published by the Hill-Clarke Machinery Co., 649 W. Washington Blvd., Chicago, Ill., contains 40 pages describing and illustrating an extensive line of remanufactured machine tools.

ROLLER BEARINGS A catalog describing a new double roll cylindrical roller bearing developed primarily for the machine tool industry has been published by SKF Industries, Inc., Philadelphia, Pa.

STAMPINGS A 46-page illustrated catalog published by the Zenite Metal Corp., West & Ohio Sts., Indianapolis, Ind., provides engineering data concerning a wide variety of stamped and rolled sheet metal products.

STEELS Details of a certified alloy steel plan are included in a 28-page illustrated booklet published by Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

SWITCHGEAR Bulletin No. GEA-2872, released by the General Electric Co., Schenectady, N. Y., contains 24 pages describing and illustrating a line of metal-clad and metal-inclosed switchgear assemblies.

TOOL STEEL A 64-page booklet published by the Columbia Tool Steel Co., Chicago Heights, Ill., presents engineering data and recommendations concerning an extensive line of tool steels.

TRUCKING A 56-page booklet published by the Four Wheel Drive Auto Co., Clintonville, Wis., tabulates the 1939 truck and trailer size and weight restrictions adopted by the various States.

TUBE FABRICATION Bulletin No. 40 D, published by the Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio, contains 28 pages describing an extensive line of tube fabricating equipment.

Spring tempered COLLETS
Order From Stock
Scientifically heat treated to a true spring temper, "Rivett Mark" collets resist wear and hold their spring longer than collets of any other make. As standard equipment on all makes of lathes and millers, (see Rivett Bulletin 100B) they may be ordered for immediate delivery from the following stocks:—
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Charles A. Strelinger Co.
149 E. Larned Street
BOSTON
Rivett Lathe & Grinder Inc.
18 Rivervew Road, Brighton
RIVETT
LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

NEW BOOKS

PATTERN MAKING — REVISED. — *By James Ritchey, former instructor in wood-working, Armour Institute of Technology. Revised by Walter W. Monroe, instructor in pattern making, Worcester Polytechnic Institute, Charles William Beese, industrial engineer, Armstrong Cork Company, and Philip Ray Hall, assistant professor of industrial engineering, Pennsylvania State College.* 233 *pages,* 5½ x 8¼ *in. Indexed and illustrated. Clothboard binding. Published by the American Technical Society, Drexel Ave. at* 58 *St., Chicago, Ill. Price,* $2.00.

The authors of this devised handbook have endeavored to cover fully the subject of pattern making, giving the tools and equipment necessary, the design details of simple and complicated patterns for typical cases, the use of green and dry sand cores, and finally the construction and design of a typical molding machine with details as to the manner in which the castings are designed to suit this machine.

Pattern making is an art requiring skill in woodworking combined with mechanical knowledge and ability to visualize the part for which the patterns are to be made. Complicated sections now used in all types of machinery have necessitated the development of a greater skill on the part of the pattern maker, as well as a wider acquaintance with the various foundry methods which have effect upon pattern construction. The duplication of castings in modern production has brought about a wide use of metal master patterns which make it necessary for the pattern maker to be a machinist as well as a carpenter.

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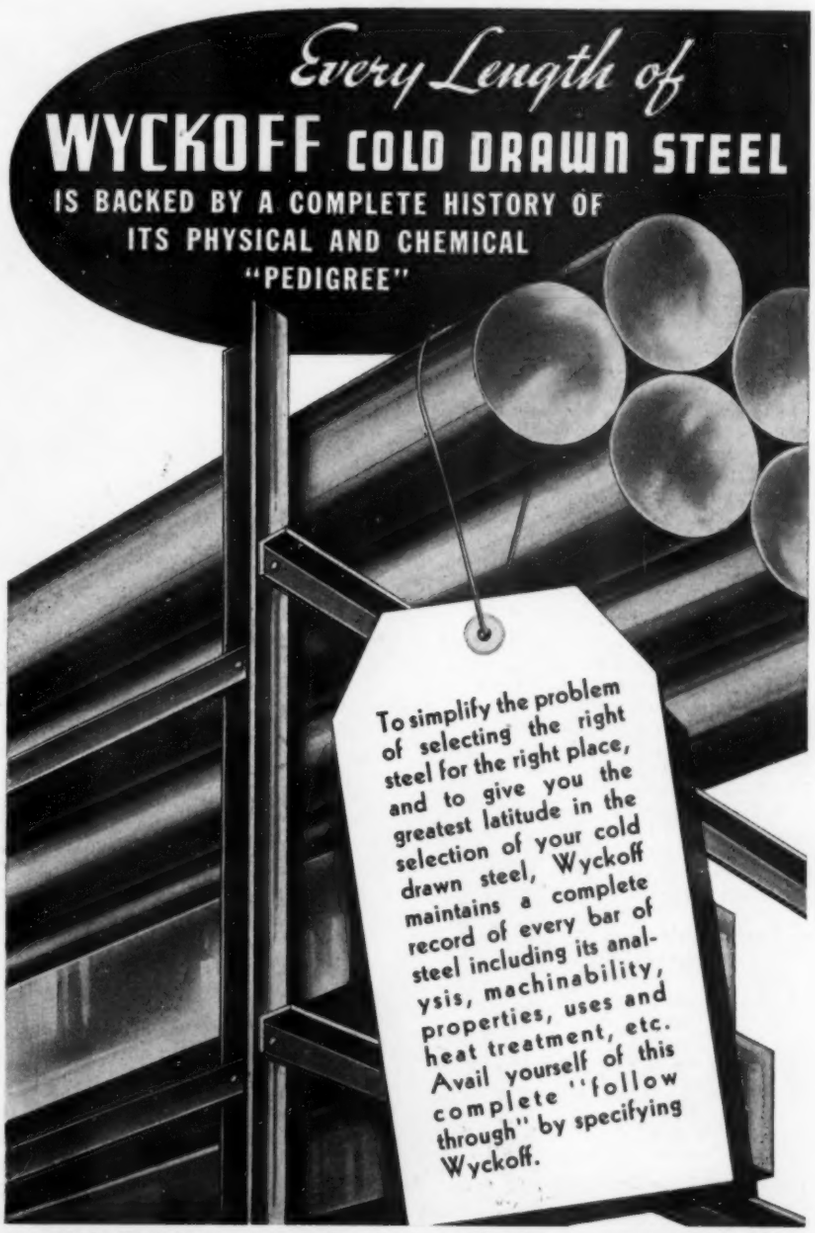
TIMESTUDY FOR COST CONTROL— *By Phil Carroll, Jr., vice-president, Dyer Engineers, Inc.* 305 *pages,* 6 x 9 *in. Indexed and illustrated. Clothboard binding. Published by the McGraw-Hill Book Co.,* 330 *W.* 42*nd St., New York, N. Y. Price,* $3.00.

This book outlines, step by step, one practical method of completing time study measurements and cost control without expensive rearrangements in the shop. The author concentrates on the preparation and use of standard data, as opposed to the making of individual operation time studies, since this method permits a wider field of application and can be used to form the basis for many managerial controls.

The first seven chapters are devoted to a discussion of the development of measurement methods and the place of time study in an industrial organization. Here, also, the author discusses the organization of a standards department, the selection and training of time study men and the equipment required. Chapters eight to eighteen inclusive are devoted to the preparation and application of standard data, including the making of the time studies and the compilation of data for the standards.

The application of these standard data and the results that can be expected are covered in the next two chapters, while Chapter 21 deals with measures that must be taken in order to maintain the standards once they have been set. Use of these standards as a basis for inventory control, determination of effective capacity, labor cost control, the determination or standard and overhead costs, pricing, profit, and the responsibility of management for the maintenance of the means of measurement all are discussed by the author in the final chapter. Included in the appendix is an extensive manual of reference data of particular value to the time study and standards engineer.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WYCKOFF COLD DRAWN STEEL
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To simplify the problem of selecting the right steel for the right place, and to give you the greatest latitude in the selection of your cold drawn steel, Wyckoff maintains a complete record of every bar of steel including its analysis, machinability, properties, uses and heat treatment, etc. Avail yourself of this complete "follow through" by specifying Wyckoff.

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OXYACETYLENE WELDING. — *By Robert J. Kehl, consulting mechanical engineer. Revised by Morgan H. Potter, instructor in charge of welding, William Hood Dunwoody, Industrial Institute, Minneapolis, Minn.* 130 *pages,* 5½ x 8¼ *in. Clothboard binding. Indexed and illustrated. Published by the American Technical Society, Drexel Ave. at* 58*th St., Chicago, Ill. Price,* $1.25.

So fast has the technique of welding progressed and its use extended during the past few years that the literature on the subject has scarcely been able to keep pace. This volume is intended to cover the practical phases of oxyacetylene welding. It is designed for use of the welding operator as well as for the superintendent and factory manager. Starting with a summary of the process itself, the volume commences with a discussion of the advantages and extent of application to various kinds of work. Next the technique of gas welding is discussed with particular reference to the apparatus used, its adjustment and the manipulation of the torch and welding rod.

A discussion of the various metals that can be welded and their peculiarities is given due consideration. This section includes the subject of hard surfacing as applied to cast iron, the alloy steels and to tipped tools.

Special uses of welding, such as application to automobile repair work and jigs and fixtures are dealt with in some detail. A brief summary of welding costs conclude the volume.

All geared 21" 24" and 28"
SUPER SERVICE UPRIGHTS

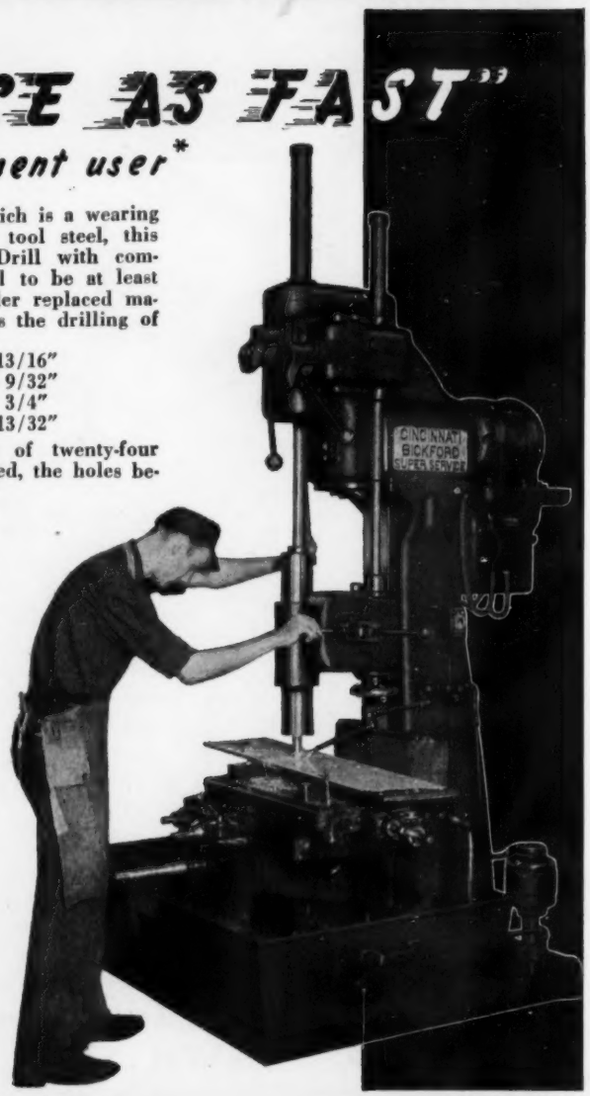
"At least
TWICE AS FAST"
says prominent user*

On the work shown, which is a wearing plate of oil hardening tool steel, this Super-Service Upright Drill with compound table, is reported to be at least twice as fast as the older replaced machine. This job involves the drilling of holes

two 1-13/16"
two 1- 9/32"
four 3/4"
twenty-four 13/32"

and the counterboring of twenty-four ¾" holes. No jig is used, the holes being located with the aid of the compound table and center-distances held to limits of ±.005". Time required is now 1½ hours, former time 3 hours. A similar replacement and like savings may be possible in your shop. Write for complete information.

*Customer's name on request.



THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

PATENTS

Printed copies of patents are furnished by the Patent Office at 10 cents each. Address the Commissioner of Patents, Washington, D. C.

December 20, 1938

Metal-Working Machinery

Material Working Apparatus, Lathe. Ernest J. Svenson, Rockford, Ill. Patent 2,140,563.

Apparatus for Turning Complex Workpieces. Clifford A. Bickel, Sidney, Ohio, assigned to the Monarch Machine Tool Co., Sidney, Ohio. Patent 2,140,949.

Engraving Apparatus. Everett J. Cook, Toledo, Ohio, assigned to H. H. Buggie & Co., Toledo, Ohio. Patent 2,140,985.

Grinding Machine. Frederick S. Haas and Winthrop Trible, Cincinnati, Ohio, assigned to Cincinnati Grinders Inc., Cincinnati, Ohio. Patent 2,141,065.

Quenching Machine. John Joseph Davenport, College Point, N. Y., assigned to James I. Quaid, College Point, N. Y. Patent 2,141,081.

Apparatus for Making Metallic Tubular Workpieces. Stevenson Findlater, McKeesport, Pa., assigned to National Tube Co., Pittsburgh, Pa. Patent 2,141,129.

Parts and Mechanism

Apparatus for Severing an Axially Moving Rod into Lengths. Félix Fréderic Ruau, Deptford, London, England, assigned to Molins Machine Co., Ltd., London, England. Patent 2,140,720.

Automatic Controlling Apparatus for Strip Feeding Mechanism. Frederick M. Littell, Chicago, Ill., assigned to F. J. Littell Machine Co., Chicago, Ill. Patent 2,140,755.

Fuse Soldering Mechanism. Elmer H. Taylor, Newburyport, Mass., assigned to the Chase-Shawmut Co., Newburyport, Mass. Patent 2,140,864.

Connecting Device. Charles Adin Fox, St. Louis, Mo., assigned to James R. Kearney Corp., St. Louis, Mo. Patent 2,140,904.

Strip Uncoiler. Howard H. Talbot and Maurice P. Sieger, Pittsburgh, Pa., assigned to United Engineering & Foundry Co., Pittsburgh, Pa. Patent 2,140,928.

Nut Lock. Henry Peirce Sorensen, Detroit, Mich. Patent 2,141,071.

Processes

Method of Producing Steel Stamps. Larry D. Donbeck, Gary, Ind. Patent 2,140,670.

Method for the Production of Ammunition Shells. John Burrell Talbot-Crosbie and Arthur Penrhyn Stanley Macquisten, Glasgow, Scotland. Patent 2,140,775.

Method of Making Dies. Walton C. Marsh, Belleville, Ill. Patent 2,140,806.

Manufacture of Metal Products. Edward R. Long, Bethlehem, Pa., assigned to Bethlehem Steel Co., Bethlehem, Pa. Patent 2,140,916.

Method of Welding. Robert M. Rooke, Jersey City, N. J., and Frederick C. Saacke, New York, N. Y., assigned to Air Reduction Co., Inc., New York, N. Y. Patent 2,141,021.

Method of and Means for Blanking, Notching, and Scoring Sheets. Charles E. Attwood, Lakewood, N. Y., assigned to Art Metal Construction Co., Jamestown, N. Y. Patent 2,141,121.

Tools and Accessories

Nut or Bolt Holder. John G. Hoff, Mansfield, Ohio, assigned to the Tappan Stove Co., Mansfield, Ohio. Patent 2,140,628.

Riveting Machine. Paul Van Sittert, Cleveland Heights, Ohio, assigned to the Cleveland Pneumatic Tool Co., Cleveland, Ohio. Patent 2,140,658.

Jig. Joseph S. Pecker, Philadelphia, Pa. Patent 2,140,762.

Means for Cooling Tools and Removing Chips. William A. Hart, Detroit, Mich., assigned to Colonel Broach Co., Detroit, Mich. Patent 2,140,838.

Vertically Adjustable Shankless Tool Bit and Holder Therefor. Ernest Reaney, Bridgeport, Conn., assigned to The O. K. Tool Co., Inc., New York, N. Y. Patent 2,140,940.

Triple Adjustment Shankless Tool Bit and Holder Therefor. Ernest Reaney, Bridgeport, Conn., assigned to the O. K. Tool Co. Inc., New York, N. Y. Patent 2,140,941.

Milling Attachment. Michael Hanna, Glen Rogers, W. Va. Patent 2,140,957.

Lubricating Device. Lionel A. Carter, Webster Groves, Mo. Patent 2,140,983.

Tube Extruding Die. William H. Lussie, West Orange, N. J., assigned to Donald Karrakis, East Orange, N. J. Patent 2,141,005.

Cover for Leader Pins. William A. Wiesman, Dayton, Ohio. Patent 2,141,027.

Burr Removing Machine. Hugh Whitman Haynes, Joliet, Ill., assigned to the American Steel & Wire Co., Cleveland, Ohio. Patent 2,141,135.

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Milling Machine. Nels S. Lundberg and Charles B. De Vileg, Jackson, Mich., assigned to the Bullard Co., Bridgeport, Conn. Patent 2,141,191.

Machine for Making Fastener Stringers. Gideon Sundback, Meadville, Pa., assigned to Talon, Inc., Meadville, Pa. Patent 2,141,200.

Nut Tapping Machine. Henry P. Selman, Detroit, Mich. Patent 2,141,280.

Lapping Device. Raymond R. Searles, New Britain, Conn., assigned to the Fafnir Bearing Co., New Britain, Conn. Patent 2,141,491.

Press. William Meier, Cleveland, Ohio, assigned to the Midland Steel Products Co., Cleveland, Ohio. Patent 2,141,657.

Wire Twisting Apparatus. Dan O'Niel, Aliquippa, Pa., assigned to Jones & Laughlin Steel Corp., Pittsburgh, Pa. Patent 2,141,661.

Grinding Machine. Carlton Eugene Brown, Cincinnati, Ohio, assigned to Cincinnati Grinders Inc., Ohio. Patent 2,141,853.

Grinding Machine. Howard W. Dunbar, Worcester, and Herbert S. Indge, Westboro, Mass., assigned to Norton Co., Worcester, Mass. Patent 2,142,020.

Grinding Machine. Charles Herfurth, Cincinnati, Ohio, assigned to Cincinnati Grinders Inc., Cincinnati, Ohio. Patent 2,142,028.

Dowel Pin Former. Willetts Peaslee, Cincinnati, Ohio, assigned to Cincinnati Grinders Inc., Cincinnati, Ohio. Patent 2,142,035.

Crankshaft Grinding Machine. John I. Garside and Carl G. Flygare, Worcester, Mass., assigned to Norton Co., Worcester, Mass. Patent 2,142,050.

Press. Isaac Harter, New York, N. Y., assigned to the Babcock & Wilcox Co., Newark, N. J. Patent 2,142,052.

Lapping Machine. George E. Hulbert and Herbert S. Indge, Westboro, Mass., assigned to Norton Co., Worcester, Mass. Patent 2,142,057.

Polishing Machine. Herbert S. Indge, Westboro, Mass., assigned to Norton Co., Worcester, Mass. Patent 2,142,058.

Automatic Universal Profile and Die Sinking Machine. Bernard Sassen, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co., Cincinnati, Ohio. Patent 2,142,061.

Parts and Mechanism

Tapping Attachment. George W. Emrick, Brooklyn, N. Y. Patent 2,141,209.

Tap Chuck. Victor Grey, Chicago, Ill., assigned to Teletype Corp., Chicago, Ill. Patent 2,141,465.

Automatic Steady Rest for Grinding Machines. George Crompton, Jr., Worcester, Mass., assigned to Norton Co., Worcester, Mass. Patent 2,141,596.

Nut Lock. Julius V. Uherkovich, Gary, Ind. Patent 2,141,701.

Adjustable Work Bed. Carl J. Hertlein, Brooklyn, N. Y., assigned to Franz Fuchs, Brooklyn, N. Y. Patent 2,141,751.

Automatic Dynamic Balancer for Machine Tools. Hans Ernst, Cincinnati, and Albert H. Dall, Silverton, Ohio, assigned to Cincinnati Grinders Inc., Cincinnati, Ohio. Patent 2,142,021.

Combined Delayed Trip and Spindle Stop Mechanism for Machine Tools. Herman Horlacher, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co., Cincinnati, Ohio. Patent 2,142,029.

Processes

Method of Machining Crankshafts. William F. Groene and Walter R. Meyer, Cincinnati, Ohio, assigned to the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. Patent 2,141,466.

Tools and Accessories

Grinding Fixture. Paul E. Lehman, Dayton, Ohio. Patent 2,141,187.

Method of an Apparatus for Opening Metal Sheets. Peter J. Murray, Toronto, Ohio, and Erwin E. Bowen, Follansbee, W. Va. Patent 2,141,218.

Offset Die. William L. Castle and William O. Hedberg, Seattle, Wash., assigned to Boeing Aircraft Co., Seattle, Wash. Patent 2,141,736.

Air Compressor Attachment and Brake for Forging Machines. William W. Criley, Cleveland, Ohio. Patent 2,141,951.

Portable Electric Drill and the Like. Charles Desoutter, London, England. Patent 2,141,971.

Work Holder Mechanism for Machine Tools and the Like. Rollin H. Patrick, Deer Park, Ohio, assigned to the Cincinnati Milling Machine Co., Cincinnati, Ohio. Patent 2,142,034.

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Worm Polishing Machine. John M. Riordan, Detroit, Mich. Patent 2,142,415.

Machine Tool, Miller. Worthy J. F. Forward, Rochester, N. Y., assigned to Consolidated Machine Tool Corp., Rochester, N. Y. Patent 2,142,439.

Grinding Machine. Donald R. Hall, Beloit, Wis., assigned to Gardner Machine Co., South Beloit, Ill. Patent 2,142,444.

Metal-Working Machine, Miller. Charles Edward Kraus, Rockford, Ill., assigned to the Ingersoll Milling Machine Co., Rockford, Ill. Patent 2,142,517.

Automatic Lathe. Frank L. Cone, Windsor, Vt.; Raymond H. Cone, Henry P. Chaplin, and Horace P. McClary, Windsor, Vt., executors. Patent 2,142,557.

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Canadian Factory WINDSOR, ONT.

Brake Drum Grinder. Harry K. Bigelow, Columbus, Ohio, assigned to Benjamin S. Lurie, Columbus, Ohio. Patent 2,142,710.

Method and Machine for Metal-Working. Rene Louis Rougemont, Rockford, Ill., assigned to the Ingersoll Milling Machine Co., Rockford, Ill. Patent 1,142,735.

Machine for Metal-Working. Rene Louis Rougemont, Rockford, Ill., assigned to the Ingersoll Milling Machine Co., Rockford, Ill. Patent 2,142,736.

Contouring Lathe or the Like. George H. Benzon, Jr., Jenkintown, and Harry Russell Young, Lower Merion, Pa., assigned to William Sellers & Co. Patent 2,142,882.

Parts and Mechanism

Drop Hammer Lifting Means. William W. Criley, Cleveland, Ohio. Patent 2,142,112.

Variable Stroke Drop Hammer Mechanism. William W. Criley, Cleveland, Ohio. Patent 2,142,113.

Integral Hammer Frame and Adjustable Ram Guides. William W. Criley, Cleveland, Ohio. Patent 2,142,114.

Control for Hydraulic Machines. James K. Douglas, Shorewood, Wis., assigned to the Oilgear Co., Milwaukee, Wis. Patent 2,142,500.

Revolving Center for Lathes and the Like. Thomas Fish, Bridgeport, Conn. Patent 2,142,639.

Processes

Hardening Process for High Speed Steel Tools and Other Articles. Adolph W. Machlet, Elizabeth, N. J. Patent 2,142,139.

Manufacture of Extruded Metal Valves. Stanley W. Sparks, Norwalk, Conn., assigned to Sparks Processes, Inc., Norwalk, Conn. Patent 2,142,702.

Method of and Apparatus for Extruding Elongated Solid and Hollow Metal Shapes. Stanley W. Sparks, Norwalk, Conn., assigned to Sparks Processes, Inc., Norwalk, Conn. Patent 2,142,703.

Method of Metal Flow and Equalized Temperature and in Extrusion Apparatus Therefor. Stanley W. Sparks, Norwalk, Conn., assigned to Sparks Processes, Inc., Norwalk, Conn. Patent 2,142,704.

Tools and Accessories

Hob and Method of Manufacture. Harry Pelphrey, Detroit, Mich., assigned to Michigan Tool Co., Detroit, Mich. Patent 2,142,285.

Electric Soldering Iron. David Williams, Binghamton, N. Y. Patent 2,142,340.

Flame Cutting Apparatus. Robert Clabeaux, Buffalo, N. Y. Patent 2,142,436.

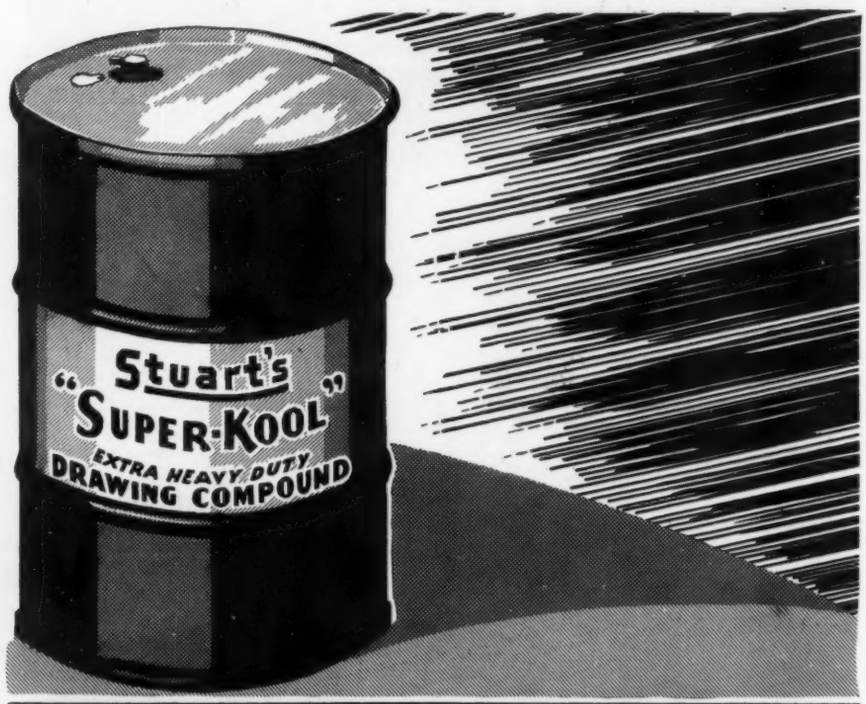
Bending Machine. George R. Goin, Detroit, Mich., assigned to Peninsular Metal Products Corp., Detroit, Mich. Patent 2,142,443.

Apparatus for Checking the Quality of Welds. David Sciaky, Paris, France. Patent 2,142,619.

Gage for Correlating Gears. Herman W. Falk and William S. Henderson, Milwaukee, Wis., assigned to the Falk Corp., Milwaukee, Wis. Patent 2,142,723.

Expansible Polishing Wheel. William Krause, West Hartford, Conn., assigned to Niles-Bement-Pond Co., Hartford, Conn. Patent 2,142,873.

Drill Grinding Machine. Roderick P. Stocking, Drexel Hill, Pa., assigned to William Sellers & Co., Inc., Philadelphia, Pa. Patent 2,142,923.



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TO THE EDITOR

Regarding Reciprocity

Dear Sir:

Under the attack on business by the present administration we manufacturers like to feel that we are martyrs. We know that attack is unjustified, in general. Government, however, has uncovered some abuses which are real enough to justify action in some cases.

One of these abuses, which as yet has not been the subject of regulation but which will and perhaps be, is that of reciprocal buying. This exploded theory is continued only because of its age, not because anyone in industry finds it a satisfactory method of placing business.

Industry, at great expense, sets up a purchasing department, an inspection department and an engineering department, to produce material of proper price and quality. After having done this they put in a reciprocal relations department who override the decisions of the buyer, the inspector, and the engineer, and place business merely because of the suppliers' results in frequent strained industrial relations since no one can buy in a volume to satisfy the reciprocator. Not only that, but the distribution is never fair from the seller's point of view.

Reciprocal buying results in higher prices since the reciprocator cannot get the best price available. It results in lower quality since the reciprocator cannot insist on quality. It results in lack of standardization which enormously increases cost of upkeep.

Yours very truly,
J. F. Lincoln
The Lincoln Electric Company